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McDonnell RF-4 Variants

by Jay Miller

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Aerofax, Inc.
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ph. 817 261-0689

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RF-4B

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THE MCDONNELL RF-4 *VARIANTS* STORY

MDD

MDD

RF-4C mock-up, at McDonnell's St. Louis facility was used to detail placement of sensors and cockpit modifications. Access to sensors and related avionics systems was given heavy emphasis in determining placement of panels and compartments. Configuration of early radar system and dish, seen in righthand photo, is noteworthy.

CREDITS:

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PROGRAM HISTORY:

The initiation of preliminary design work on the McDonnell F-4 *Phantom II* as the Model 98-A single-seat attack fighter, on August 25, 1953, was inadvertently the birth of the most successful tactical reconnaissance aircraft of the post-WWII era. It is beyond the scope of this Minigraph to reiterate the complete history of the ubiquitous F-4, but suffice it to say that the first recce configurations were not long in coming after the unveiling of the original design studies. In fact, the original recce airplane proposal, under the auspices of the Model 98-F designator, was shown to the Navy on the same date as the Model 98-A. Significantly, the differences between the two were more than simply academic, as the Model 98-F utilized the basic Model 98-B configuaration and as such, had increased wing area, increased fuel capacity, and most importantly, two J79-GE-2 turbojets in place of the Model 98-A's two J67-W-I's. In addition, the Model 98-F deleted all the Model 98-B's armament complement and replaced it with an optical sensor package.

Unfortunately, nothing of importance came of the Model 98-F proposal and it would be no less than five years before another Model 98 recce configuration study would bear serious fruit. This would be the Model 98-AX, which was a recce variant optimized for use by the Air Force. The Model 98-AX did not incorporate a sensor system nose, but it did make concessions for various podded sensors, including cockpit modifications, a beefed-up landing gear, and removal of the tail hook and wing folding mechanisms (weight saving measures).

Strong AF interest in the initial Model 98-X study spurred additional recce F-4 work which eventually culminated in the then-definitive Model 98-DF configuration. Born on January 3, 1961, this design, as the RF-110A, would initially be assigned the YRF/RF-4C designator. The following is a complete listing of all known McDonnell Model 98 recce configuration studies, including the RF-4C and follow-on variants (Model #/Customer/Date/Description:

98-F/USN/8-25-53/As 98-B except armament items replaced by photographic equipment. Two J79-GE-2.

98-AK/USN/9-25-57/All-weather recce version of F4H-1, to have been designated F4H-1P. Two-place. Length 58'4.23''. Fuselage nose forward of f.s. 77 changed. Forward and aft missile provisions removed. Equipment and cockpit areas revised for following recce equipment: AN/ARC-58; AN/APN-116; inertial navigation system (by Litton); AN/APQ-56 (bright display for R.O.); NASARR; integrated bright display and recorder unit; two external antenna pods; stereo TV viewfinder w/camera blisters; camera control system; day cameras (1 x KA-30 w/9'' lens, 1 x KA-30 w/12'' lens, 3 x KA-30 w/6'' lens); night cameras (2 x KA-X continuous strip stereo, 1 x IR detection system). Landing gear strengthened and internal fuel capacity increased by 98 gal. Alternate equipment could include centerline pod w/ELINT equipment; centerline pod for continuous terrain light bank. Two J79-GE-2.

98-AX/USAF/9-26-58/F4H Tactical Strike Recce airplane. Basic two-place F4H-1 w/following modifications: minor fuselage changes to accommodate new equipment; NASA Ames 10-deg.-14-deg. inlet duct ramps; integrated cockpit display; additional fuselage store station; larger (31 x 11.5) main landing gear wheel and tires; removal of tail hook and wing folding mechanisms. Fuel: internal, 2,191 gal.; external 1,340 gal. Airplane length 58'3''. Two J79-GE-8.

98-BC/USN/6-10-59/Advanced recce F4H-1 version. (F4H-1P/Q) w/following changes: modified nose shape for camera equipment; viewfinder window fairing; side-looking radar antenna fairings. Alternate version of F4H-1P/Q carries ELINT pod on fuselage centerline store station. Can carry special weapons adding attack capability without loss of normal recce functions. Two J79-GE-8.

98-BW/USN/1-5-60/F4H-1P Advanced recce weapon system (modified). Two J79-GE-8.

98-DF/USAF/1-3-61/Mission all-weather, high-low, day-night recce. Optional air-to-air missile combat or air-to-ground attack. Two man crew, tandem cockpit. Wingspan 38'4.9''. Length 60'10.9''. Basic T.O. weight 43,417 lbs. Internal usable fuel 1,889 gal. AN/ASQ-19 integrated electronic control. AN/ASN-39 camera. Low and high altitude camera. Photo flash detectors. SLR. 17'' x 24'' radar antenna dish. Infrared recon subsystem. Armament equipment includes *Sidewinder* and *Bullpup* missiles and special and conventional weapons. Two J79-GE-15.

98-DH/USN-USMC/5-9-62/Recce version of F4H-1, two-place. Internal fuel 1,910 gal. External fuel 1,340 gal. Length 60'10.9''. Optical sensors for cameras. Electrical sensors for radar and IRRS. Inertial nav. system. Ejected flares. Optical viewfinder. Jettisonable cassette for film ejection. Provisions for alternate photographic configurations. SLR, infrared recce system. Forward looking radar. Aux. data recording voice recorder. Forward looking radar scope recorder. Integrated sensor control system (ISCS). V/H computer. High Altitude altimeter. Two J79-GE-8.

98-DS/USAF/3-18-63/Basic RF-4C w/J79/J1B engines and 15-deg. stabilator.

98-EH/RAAF/7-22-63/Basic RF-4C configured by modifications as follows: replace the forward fuselage (ahead of f.s. 249.65) w/RF-4B forward fuselage. 15-deg. stabilator. Remove SLR, i.r. mapper, boom receptacle (add 14 gal. fuel). Add AN/AWW-1 fusing panel; depressible reticle sights, provision for MER and TER racks, wiring and controls, 600 gal. wing fuel tank. Two J79/J1B.

98-EK/USN/10-18-63/RF-4B to be configured as follows: 15-deg. stabilator w/increased area, high lift wing (conf.4), 600 gal. external wing tanks, increased fuel volume in #1 and #2 tanks. Landing gross weight shall be 38,000 lbs., at 24' fps, extra extendible nose gear, stronger main gear w/increased stroke and larger wheels and tires (30 x 11.5-14.5 type VIII), modification of inertial nav. system to include transfer alignment. All other equipment will remain the same as on the present RF-4B; brazed hydraulic and pneumatic lines, weight saving items—titanium BLC, titanium fasteners, and one-piece windshield, provisions for ALQ-100 ECM system. Two J79-GE-8.

98-EL/USAF/10-18-63/RF-4C to be configured as follows: 15-deg. stabilator w/increased area, high-lift wing (conf. 4), 600 gal. external wing tanks, increased fuel volume in #1 and#2 tanks. Equipment remains the same as in the present RF-4C: brazed hydraulic and pneumatic lines, weight saving items—titanium BLC, titanium fasteners, and one-piece windshield, provisions for QRC-160 ECM pods. Two J79-GE-15.

98-FL/USAF/4-24-64/RF-4C configured for automatic terrain following. Two J79/J1B.

98-FP/USN/7-15-64/RF-4B w/following changes: 2 x J79/J1B engines, internal fuel of 2,091 gal., 2 x 600 gal. wing tanks, fuselage length + 18'', wing area 595 sq.', BLC flaperon, O.W. aileron, hor. tail area 119 sq.', minus 15-deg hihedral, main landing gear tire size 30 x 11.5, extra extendible nose gear, strobe light pod, miniaturized CNI, high freq. com. set, improve radar mapping set SLR, micro-miniaturized flight director group, remove jackpads for landing gear, remove bellmouth oil cooler, remove cabin heat auto-control, use titanium for stn. stl, intermediate sheet metal gauges, rigid wing fuel transfer line, chemically milled cockpit floot, keel web redesign. Two J79/J1B.

98-FQ/USAF/7-15-64/RF-4C w/following changes: internal fuel to be 2,081 gal. 2 x 600 gal. wing tanks, plus 18'' fuselage length, 595 sq.' wing area, BLC flaperon, O.W. aileron, 119 sq.' horizontal tail area, minus 15-deg. dihedral, nose landing gear drag brace, strobe light pod, full miniaturized CNI, ARN-52 miniaturized TACAN, 3500 UHF channel, miniaturized CNI set, AVCO AT-400 HF com. set, improved accuracy version (MINAC) airborne nav. computer set, improved radar mapping set SLR, micro miniaturized flight director, remove jackpads on landing gear, remove bellmouth oil cooler, remove cabin heat auto-control, use titanium for stn. stl. intermediate sheet metal gauges, rigid wing fuel transfer line, chemically milled cockpit floor, keel web redesign. Two J79/J1B.

98-GC/USN/12-2-64/RF-4B w/2,283 gal. internal fuel, 600 fuselage length, 640 sq.' wing area, 119 sq.' hor. tail area, HF com. set AVCO AT-400. Two J79/J1B.

98-GD/USN/12-2-64/RF-4B w/2,283 gal. internal fuel, 600 fuselage length, 640 sq.' wing area, HF com. set AVCO AT-400.

98-GI/?/?/F-4E w/English recce pack equipment in pod.

98-GJ/?/?/F-4E w/English recce pack plus RF-4C SLR in pod.

98-GK/?/?/RF-4C w/English recce equipment internally carried.

98-GL/?/?/RF-4C w/English recce equipment plus SLR internally.

98-GN/RAF/1-21-65/F-4K w/P.1154 photo recce equipment. Added electronics to be INS. F-4D bomb computer, lead computing sight, RF com. (SSB) AN/ARC-105. Remove dual controls.

98-GP/?/1-22-65/F-4K w/RF aft fuselage and P.1154 recce pod as configured by British.

98-GT/USN/6-25-65/EW version based on F-4B, capable of carrying one CCM and chaff pods externally and passive receiving equipment internally. Above must be in Navy inventory to ensure early operational availability of the a/c. *Shrike* will be carried on wing stations in lieu of fuselage mounted *Sparrows*—well covers added.

98-HC/?/9-14-65/Improved electronics, quick access to recorders. Environment for components shall be from minus 10-deg. C to plus 55-deg. C. Provide a readout scope and control panel in the R.O.'s compartment.

98-HG/?/11-2-65/Tactical ELINT using basic RF-4C and adding TRW ELINT equipment installed internally.

98-HH/?/4-11-65/Very advanced RF-4C, w/forward looking radar, internal ELINT, two KA-60 LAP cameras, laser camera, improved IR mapper, advanced INS, data transfer capability, 98-HC basic aircraft.

98-HI/?/7-11-65/RF-4J proposed for sales department, RF-4B (SD-513-IR-1-R1) basic aircraft w/improved carrier suitability.

98-HJ/?/8-12-65/Very advanced RF-4C, 98-HC basic aircraft with priority over 98-HH, APQ-99 forward looking radar, improved IR mapper, electronic intelligence system pod.

98-HM/?/2-14-66/Basic RF-4C w/nothing removed except SLR. Provisions for SLR (i.e., mounting, cooling, etc.) would be retained. Airborne Instruments Laboratory ELINT equipment would be installed in place of the SLR.

98-HP/?/6-1-66/Briefing for Federal Republic of Germany on RF-4C, F-4E, and F-4E+.

98-HQ/?/6-1-66/The RF-4 versions will be based on the FY 1967 RF-4C detail spec.

98-HT/USAF-RAF?/6-21-66/Referred to as RF-4M. Thought to be recce mod optimized for IR spectrum. Carried EMI recce pod.

98-HV/USAF/6-30-66/Known as RF-4J. Two aircraft modified w/special ELINT equipment for AF use.

98-JA/German Tri-service/7-20-66/Advanced RF-4C w/Conductron SLR installation, incorporates futuristic SLR, features X-band ground mapping and L-band hard target detection. Certain photographic capabilities are retained for both daylight and night recce.

98-JB/German Tri-Service/7-26-66/Conductron SLR installation in present RF-4C nose.

98-JC/German Tri-Service/7-26-66/Conductron SLR installation centerline pod on present RF-4C.

98-JD/German Tri-Service/8-8-66/Goodyear SLR in present RF-4C nose.

98-JG/USAF-WGAF/8-26-66/RF-4E inboard profile mod.

98-JL/USAF/9-21-66/Special RF-4C modified for electronic recce.

98-JQ/USAF/11-29-66/RF-4C w/48'' Goodyear SLR and improved electronics.
98-JR/USAF/12-8-66/Retrofit of TALACS in RF-4B for AF.
98-JY/WGAF/1-3-67/Installation of AN/AAS-18 in RF-4C.
98-JZ/USN/1-18-67/F-4B retrofit to RF-4B; J79-GE-8 engines retained; carrier suitable; RF-4B equipment to be configured per SD-513-1R-1.
98-KB/WGAF/8-18-67/RF-4E with RF-4C features—J79-GE-17 engines, KS-87 frame camera.
98-KJ/USAF/4-17-67/SLR data transfer system for RF-4E.
98-LA/USAF/10-16-67/RF-4C update.
98-LB/USAF/9-21-67/RF-4E Mk.II; all-weather, high-low, day-night recce, optical, air-to-ground, special weapon, attack, 2-man crew, tandem cockpit, SLR, night photographic system, #7 fuel tank, wet runway landing improvements.
98-LC/USAF/10-16-67/F-4D w/I.R. data transmission capability from RF-4C.
98-LG/WGAF/?/RF-4E as delivered to WGAF. This designator also applied to Precision Attack Weapons System (PAWS) in 3 F-4D's (10-25-67)
98-LJ/German Tri-Service/12-14-67/RF-4E advanced recce airplane.
98-LT/USN/4-22-68/Advanced 65 RF-4B recce aircraft.
98-MA/USMC/7-23-68/RF-4B update configuration.
98-MG/USAF/?/FMS strike/reconnaissance.
98-MI/USAF/2-4-69/RF-4C for Israel incorporating J79-GE-17 engines and deleting nuclear capability and specific sensitive equipment.
98-MP/USN/3-14-69/Navy RF-4 configuration.
98-MR/USAF/5-5-69/JIFDATS prototype installation in RF-4C a/c.
98-MV/AEA210/7-8-69/Strike-recce F-4E for foreign military sales.
98-MX/AEA212/7-8-69/Strike-recce F-4E for Royal Netherlands AF.
98-NA/AEA-215/5-19-70/Reconnaissance version of RF-4J for Navy.
98-ND/?/7-7-70/RF-4C/IR.
98-NL/USAF/12-16-70/Japanese version of RF-4E w/SLR.
98-NT/USAF/7-16-71/Conversion of RF-4C to EF-4C.
98-PA/FMS/9-22-72/F-4 w/recce pod.
98-PF/USAF/12-4-72/RF-4 for advanced tactical recce.

The RF-4C was officially ordered on April 5, 1962 (with production RF-4C SOR 196 contractual go-ahead approved on Dec. 31, 1962), and just over six months later, on October 31, the full-scale mock-up underwent AF inspection. Mock-up approval cleared the way for the construction of the first prototype (airframe #266) and eight months later, in July of 1963, assigned AF serial no. 62-12200, it was rolled out. Modifications to the otherwise stock F-4B airframe included the removal of the front two missile bays, the retention of the slim F-4B tires and wheels while the wing was bulged on top for the larger AF wheels and tires, and necessary cockpit modifications to accommodate sensor system requirements.

This first recce *Phantom II*, eventually became a singularly important F-4 testbed. Originally scheduled to be completed as a USN F-4B, it became not only the first (AF) RF-4, but also the prototype F-4E, the prototype "slatted" F-4, one of the first aircraft fitted with fly-by-wire controls, and the testbed for the PACT (Precision Aircraft Control Technology) program.

The first flight of the YRF-4C, without its intended nose-mounted sensors, took place on August 8, 1963, from the McDonnell plant at St. Louis, Missouri, with test pilot Bill Ross at the controls. The airplane remained airborne for almost an hour while Ross cycled various systems and undertook preliminary control and handling tests. Two weeks later, following two more flights, '12200 was delivered to Edwards AFB, California. McDonnell test pilot George Eaton then completed additional testing during the following month and passed the airplane on to Ray Hunt. Hunt continued flight test work with '12200 through the end of the year, and in January of 1964, delivered it to Holloman AFB, New Mexico for sensor system testing.

Hunt and fellow McDonnell test pilot Irv Burrows explored '12200's capabilities as a recce platform throughout most of the following year. Altitudes included everything between 200' and 40,000', and speeds of between 200 and 700 knots. The optical sensors were tested against a variety of known targets during both day and night missions. Flare ejections at night, particularly at high speeds and low altitudes were observed to be extraordinarily spectular.

It is interesting to note that preliminary evaluation of the F-4 as a recce platform had taken place in 1963 at Holloman AFB using F-4A #9 (BuNo. 145310). Various sensor systems, primarily of the podded optical type, were tested using this slightly modified airframe.

By early 1965, recce test work with '12200 had been completed and the airplane returned to McDonnell. There, it continued flight test work related to a large number of programs. Eventually it would complete a total of 737 flights while logging a total of 952.1 hours of flying time. In honor of its many contributions to aeronautics, and the F-4 program in particular, '12200, on January 9, 1979, was turned over to the US Air Force Musuem at Wright-Patterson AFB, Ohio. Transported to the Museum rather ignominiously by a Sikorsky CH-54B, it became permanently enshrined as one of the most famous members of the mighty "Phantom II" family.

A second RF-4C prototype, '12201 (airframe #268), was also used extensively during the course of the flight and systems test programs. This airplane, often seen in its distinctive white and red markings, was eventually turned over to the AF training facility at Chanute AFB, Illinois, there to serve as a training tool for neophyte AF maintenance personnel.

Approximately sixteen months after the birth of the official AF recce F-4 program, the Navy and Marine Corps agreed to sign a joint effort contract calling for a similar airplane for Marine Corps use. Initially referred to as the F4H-1P, and later as the RF-4B, the new airplane was basically a stock F-4B with an RF-4C nose. It was given contractual go-ahead on February 21, 1963, and the full-scale mock-up inspection tooke place the following July 25th. The Navy, at the beginning of this program, seriously entertained thoughts of acquiring a recce F-4 variant of its own. An existing and still fairly young fleet of Vought RF-8's hindered Congressional funding appropriation for this project, however, and the Navy RF-4 program was eventually still-born.

The first flight of the prototype Marine Corps RF-4B, BuNo. 151975, took place from McDonnell's St. Louis facility on March 12, 1965. This airplane was part of an initial order calling for 12 aircraft which was later amended and expanded to include a total of 36 aircraft. Still later, during the peak of the war in Vietnam, it was recognized that additional RF-4B's were needed to service Marine and Navy tactical recce requirements and to replace those aircraft that had been attrited. Ten new aircraft were ordered, these being unusual hybrid RF-4B's that were built up of F-4J wing assemblies (with upper wing fairings to accommodate the larger wheels and tires), RF-4C fuselage and vertical fins, and some RF-4C nose sections.

The initial AF order called for a total of 26 RF-4C aircraft. The first of these, 63-7740, took to the air for the first time on May 18, 1964. Initial plans called for the RF-4C to equip fourteen Tactical Air Command squadrons with the first to be activated by early 1965. At it were, the first production aircraft were quickly assigned to the 33rd TRTS at Shaw AFB, S. Carolina, on September 24, 1964. They remained at Shaw for the following year while minor sensor system problems were overcome, eventually transferring to the first operational RF-4C squadron, the 16th TRS. This unit was declared combat ready in August of 1965 under the auspices of the 460th TRW, and on October 30, 1965, nine of its RF-4C's were deployed to Tan Son Nhut AB, Vietnam. One day later, it became the first RF-4 unit to enter combat in SEA.

On February 4, 1967, the first PACAF aircraft were received by the 15th TRS/18th TFW and these aircraft were soon seen in operation over Vietnam. Vietnam proved a demanding and expensive proving ground for the RF-4C, and before the final departure of US equipment and personnel in 1974, no less than 84 RF-4C's were written off (23 aircraft were lost during 1967, alone).

A total of 505 RF-4C's were eventually completed for AF use. At various times these aircraft served with the following units:

3rd TFW		Clark AB, PI	PN
	15th TRS	Clark AB, PI	PN
10th TRW		Alconbury, England	AR
	1st TRS	Alconbury, England	AR
	30th TRS	Alconbury, England	AS
	32nd TRS	Alconbury, England	AT
18th TFW		Kadena AB, Okinawa	ZZ
	15th TRS	Kadena AB, Okinawa (Osan AB, Korea)	ZZ
26th TRW		Zweibrucken AB, W. Ger.	RS/ZS
	17th TRS	Zweibrucken AB, W. Ger.	ZR
	38th TRS	Ramstein Ab, W. Ger.	RR/RS/ZR
67th TRW		Mountain Home AFB, ID	KR
	7th TRS	Mountain Home AFB, ID	KT
	10th TRS	Mountain Home AFB, ID	KR
	11th TRS	Mountain Home, AFB, ID	KV
	22nd TRS	Mountain Home, AFB, ID	KS
67th TRW		Bergstrom AFB, TX	BA
	12th TRS	Bergstrom AFB, TX	BC
	45th TRS	Bergstrom AFB, TX	BB
	91st TRS	Bergstrom AFB, TX	BA
75th TRW		Bergstrom AFB, TX	
	4th TRS	Bergstrom AFB, TX	BB
	9th TRS	Bergstrom AFB, TX	BC
	91st TRS	Bergstrom AFB, TX	BA
86th TFW		Zweibrucken AB, W. Ger.	
	17th TRS	Zweibrucken AB, W. Ger.	ZR/ZS
363rd TRW		Shaw AFB, SC	JO/SW
	11th TRS	Shaw AFB, SC	JO?
	16th TRS	Shaw AFB, SC	JM
	18th TRS	Shaw AFB, SC	JP
	33rd TRTS	Shaw AFB, SC	JL
	62nd TRS	Shaw, AFB, SC	JO/SW
432nd TRW		Udorn RTAFB, Thailand	
	11th TRS	Udorn RTAFB, Thailand	OO
	14th TRS	Udorn RTAFB, Thailand	OZ/UD
460th TRW		Tan Son Nhut AB, RVN	
	12th TRS	Tan Son Nhut AB, RVN	AC
	16th TRS	Tan Son Nhut AB, RVN	AE
475th TFW		Misawa AB, Japan	
	16th TRS	Misawa AB, Japan	UE
391st TFS?		NKP	UD
4485th TS		Eglin AFB, FL	EG OT
6510th TW		Edwards AFB, CA	ED
3246th TW			
	3247th TS	Eglin AFB, FL	AD

The Air National Guard initially received RF-4C's when Alabama's 106th TRS began converting from Republic RF-84F's in February of 1971. Since then, a number of Air Guard units have transitioned into the RF-4C. Guard units that either are equipped or were equipped with the RF-4C include:

106th TRS/117th TRW	Alabama ANG, Birmingham, AL
160th TRS/187th TRG	Alabama ANG, Montgomery, AL (now F-4D's)
190th TRS/124th TRG	Idaho ANG, Boise, ID
170th TFS/183rd TRG	Illinois ANG, Springfield, IL (now F-4D's)
165th TRS/123rd TRW	Kentucky ANG, Louisville, KY (KY code)
179th TRS/148th TRG	Minnesota ANG, Duluth, MN (now F-4D's)
153rd TRS/186th TRG	Mississippi ANG, Meridian, MS (KE code)
173rd TRS/155th TRG	Nebraska ANG, Lincoln, NB
192nd TRS/152nd TRG	Nevada ANG, Reno, NV

(It has also been noted that the Texas Air National Guard's 111th FIS/147th FIG had an RF-4C at its Ellington AFB facility for a short while)

The first of the 46 RF-4B's eventually completed were turned over to two Marine squadrons in 1965. These were Marine Composite Reconnaissance Squadron Two (VMCJ-2) at MCAS Cherry Point, NC, and VMCJ-3 at MCAS El Toro, CA. Drawing from the resources of these squadrons, a third squadron, VMCJ-1, received RF-4B's in Vietnam in 1966.

Late in 1975, Marine Tactical Reconnaissance Squadron Three (VMFP-3) was formed at MCAS El Toro using all VMCJ-1-2, and -3 RF-4B assets under a single-site, single-mission concept. Using this approach, it was determined that all of the squadrons would be stationed at one base (El Toro) with detachments assigned to certain land bases and aircraft carriers.

Due to a high sensor system usage rate in Vietnam and on-going sensor technology improvements, the RF-4B, by 1975, was determined to have serious deficiencies in its sensor system complement. With these factors in mind, the Marine Corps and Navy reached an agreement with McDonnell calling for the remaining Marine Corps RF-4B's to be put through an extensive refurbishment program under the acronym of SURE (Sensor Update and Refurbishment Effort). Conducted as a joint effort of the Naval Air Rework Facility, North Island, and the McDonnell Aircraft Company, SURE was designed to supply the Marine Corps with, as nearly as possible, a standard configured aircraft with new reconnaissance sensors. The program was expected to extend the service life of the RF-4B until well into the 1980's.

Initially, McDonnell had the primary responsibility for integration and installation of four new avionics and sensor systems into an RF-4B bailed to the contractor. After factory validation and verification of the kit, twenty-eight additional kits were sent to NARF North Island, for installation in remaining RF-4B aircraft. The new systems included the AN/ASN-92 Carrier Alignment Inertial Navigation System (CAINS); the AN/ASW-25B Data Link System; the AN/APD-10 Side-Looking Radar; AN/AAD-5 Infrared Reconnaissance Set; and the AN/ALR 45/50 (in place of the AN/APR-25/27). The AN/ALQ-26 was also added in place of external ECM pods.

The SURE project, at NARF North Island, brought RF-4B aircraft as nearly as possible to a single, standard configuration with structural modification and wire bundle changes designed to extend aircraft service life through the 1980's.

USAF RF-4C's have, themselves, gone through a number of improvement programs of their own and, in fact, are slowly being cycled through several update projects at this time. One of these is the new Litton Industries AN/ALQ-125 Tactical Electronic Reconnaissance Sensor (TEREC) system and the other is the Lear Siegler ARN-101 navigational unit with digital avionics (it is often referred to as the DMAS—Digital Modular Avionics System).

TEREC (in an early configuration it was known as *Pave Onyx*) entered limited production (the initial order was for 19 kits, though this was later increased to 23) in the late 1970's and is being slowly retrofitted to select RF-4C aircraft as they progress through depot maintenance. Eighteen TEREC equipped aircraft were initially scheduled to equip three TAC squadrons. Four of the remaining five aircraft were to be deployed at maintenance and overhaul depots, and the fifth was to be used to test new system software.

The AN/ALQ-125 TEREC system evolved in response to a need to establish and maintain the hostile electronic order of battle (EOB) in a tactical arena. Implicit in the USAF's need is the capability for rapid threat recognition and location, in addition to dissemination of this vital information to tactical commanders at all levels in the command structure. In this context, TEREC provides two options: a cockpit display for operator readout, which provides onboard EW operators with the ability to pass along data to other users, and a second option of a data

link that transmits information to selected ground sites.

The ALQ-125 system provides automated threat recognition, direction of arrival, and threat location of ground based hostile emitters—including highly mobile SAM and AAA batteries. The system is fully automatic except for control provisions that permit the operator to monitor system operation and to designate which threat location should be displayed. Also provided is computer-directed frequency search over a broad bandwidth. High probability of signal intercept is provided through rapid flexible tuning which gives rise to threat signal recognition through signal parameter measurements.

TEREC uses two antenna arrays to provide coverage for the left, right, and both sides of the aircraft. The left, right or both sides option is under operator control. In compute control, the receiving subsystem scans through preprogrammed RF ranges of interest. Once data is in the TEREC computer, a direction of arrival is calculated on the basis of quantized values measured by an interferometer.

Other operator controls include a tape recorder, data link, system power, and coverage side. In addition, a built-in-test (BIT) function can be performed at operator discretion.

TEREC's general purpose digital computer enables automatic data collection, data processing, and reformatting of the data for display, data linking, and magnetic tape recording. In addition, the computer provides control of various ancillary functions necessary for proper system operation.

TEREC relays information on a real time basis. It is programmed to recognize the characteristics of ten types of enemy radar and to search automatically for the five highest-priority type emitters. It then tracks them long enough to obtain a series of direction-finding fixes to compute emitter position relative to the aircraft position, which itself is determined by data received from its Lear Siegler ARN-101 Loran C/D receiver or an on-board inertial navigation system. Information on the type of emitter, its location, and the time-of-intercept is transmitted back immediately to a small receiver ground terminal via data link using either the RF-4C's UHF or longer range HF transceivers.

The ALQ-125 weighs about 450 pounds and employs two antenna arrays. The latter use phase-interferometry techniques to determine the direction of arriving emitter signals.

The ARN-101 DMAS is an integrated navigation, reconnaissance, and weapon delivery system installed to enhance the all-weather reconnaissance capabilities of the RF-4C. Unlike earlier systems, it allows enroute course changes without fear of loss of navigation accuracy. Replacement of the original navigation system with the ARN-101 is considered by many RF-4C pilots to be the single most important improvement in the RF-4C since the type first entered AF service.

The past few years have also seen the integration of the rather hefty Pave Tack system pod (AN/AVQ-26) into the RF-4C inventory. This unit contains an Infrared Detecting Set (IDS) and a Laser Target Designator (LTD) mounted in a pod that is normally carried on the RF-4C centerline station. The IDS provides a TV display of radiated infrared energy during day and night operation, and the LTD transmits a pulsed laser beam used to deliver laser guided weapons. The return laser pulses provide slant range measurements used for ranging and updating the AN/ARN-101. The IDS (AN/AVQ-9) is a high-resolution thermal-imaging sensor. The IDS can detect targets from sufficient altitude for weapon delivery and can be used as an aid in navigation and terrain avoidance. The IR receiver senses the radiated infrared energy and converts it into a video signal which is displayed on the control indicator and on the front scope.

Another recent development is the Electronic Wide Angle Camera System (EWACS) developed by Chicago Aerial Industries. This provides photos which cover 140 degrees of field. EWACS tests, conducted in 1977 at Eglin AFB, Fl., proved the effectiveness of the 60 lb. system which occupies less than 1 cubic foot. EWACS photos are stored on magnetic tape for transmission to ground interpretation units.

It should also be noted that a contract was recently awarded to Texas Instruments for the development of a new forward looking radar system for the RF-4C. This unit is designed to collect tactical intelligence in hostile territory during day or night and in all-weather conditions. The contract provides for the design, development, and fabrication of improved components for the AN/APQ-99/162 forward looking radar system already found on many RF-4C's.

Another addition to the RF-4C mission repertoire is the

MDD via Marty Isham

The first flight of the prototype RF-4C, 62-12200, took place on August 8, 1963, from McDonnell's St. Louis facility. As can be seen, the landing gear were not retracted during the course of the flight. The last RF-4C rolled from MDD's production line on January 16, 1974.

MDD

The second prototype RF-4C, 62-12201, was given a high visibility red and white paint scheme and served as a systems and performance testbed for the type. This particular aircraft, along with most of the initial 1962 production batch, did not enter the operational AF inventory.

MDD

The first production RF-4C, 63-7740, made its first flight on May 18, 1964. In photo, 63-7740, in the grey-on-white paint scheme found on almost all RF-4C's delivered in 1964, is seen equipped with early small centerline external tank.

Pete Bulban

Second production RF-4C, 63-7741, taxies in to McDonnell facility following pre-delivery test flight. Non-standard VHF antenna is visible on fuselage spine behind rear canopy. Anti-glare panel on nose was black.

MDD

Fifth production RF-4C, 63-7744, was painted in testbed markings and used accordingly. The nose radome and anti-glare panel were black, the primary fuselage color was white, and the vertical fin, slab stabilator, and outer wing panels were red.

integration of SCAR (Strike Control And Reconnaissance) tactics to the basic mission profile. SCAR calls for the RF-4 to lead attacking allied aircraft into a target area for weapons delivery. An adjunct to the recent additon of the ARN-101, SCAR permits the RF-4 to work as a high-performance FAC (Forward Air Control) airplane. Direct visual sightings of target areas are required of SCAR-dedicated RF-4's, and accordingly, many RF-4C aircrews are being cycled through schools for special related training. As part of the SCAR concept, there are tentative plans calling for the incorporation of armament systems aboard the RF-4 permitting the carriage of conventional air-to-ground stores.

The RF-4C has always been nuclear capable, though in recent years this capability has been removed from many of the aircraft in the inventory. Nuclear weapons can be suspended from the centerline lugs. Some RF-4C's, such as those of the 10th TRW, were even equipped with LABS (Low Altitude Bombing System).

A significant number of F-4's configured for reconnaissance have been sold to the air forces of countries other than the US. Among the most significant of these is the RF-4E, which initially was developed specifically for the Federal Republic of Germany.

The first production F-4E multi-purpose fighter for air-superiority, close support, and interdiction missions, made its first flight on June 30, 1967. It had been preceded into the air by the prototype for the series, RF-4C '12200 modified to incorporate the installation of a 20mm rotary gun in the nose. The birth of the F-4E heralded the eventual development of the ultimate foreign air force recce F-4 variant, the RF-4E.

Differing from the RF-4B and RF-4C in having more powerful General Electric J79-GE-17 engines rated at 17,900 lbs. th. ea. in afterburner, the F-4E is significantly more capable than either of its two predecessors in terms of payload and overall performance. Additionally, the -17 engines offer an improved specific fuel consumption figure and thus give the RF-4E a significant increase in range. An updated and improved sensor system package was also developed for the RF-4E (specific improvements included an updated UPD-4 SLR and, for WGAF aircraft, the ability to carry a dedicated external SLR pod), which was eventually ordered in significant quantities by a number of foreign military services. Among these were the Federal Republic of Germany (88); Greece (8; ff. 9-29-78); Iran (32—some sources indicate 21; ff. 11-16-71, f.del. 12-71); Israel (12; ff. 12-14-70, f.del. 2-71); Republic of Korea (19); and Turkey (8—some sources indicate considerably more; ff. 9-15-78). Additionally, a "customized" RF-4E, designated RF-4EJ, is in use by the Japanese (14; ff. 9-25-74, f.del. 11-74).

The first flight of the first RF-4E (69-7448) took place on September 15, 1970, and the first aircraft off the production line were delivered to Germany on January 16, 1971. There, on January 20, 1971, they joined AKG-51 at Bremgarten. This unit eventually received a total of 42 aircraft, these replacing the inventory of RF-104G's that had served in the reconnaissance role throughout the 1960's. AKG-52 at Lech was the next to receive RF-4E's, the first of these arriving on September 17, 1971. Several aircraft delivered to the Luftwaffe were never allocated to either AKG-51 or AKG-52 but instead were utilized for test and training work (at ESt61). WGAF serial numbers applied to these aircraft in order of delivery were 3501 thru 3588.

Though no longer in use by the Royal Air Force, a reconnaissance pod was developed for transport by British derivitives of the *Phantom II* (i.e., F-4K and F-4M). The pod and its various sensors were developed by EMI and built by Hawker Siddeley at their Brough facility. The pod's main sensor units consisted of an EMI Electronics Type P391 Q-band high resolution SLR, an infrared scanner, and a variety of cameras. The main parts of the recce pod consisted of left and right aerials, a transmitter/receiver, a modulator, a recorder, power units for each transmitter/receiver and recorder, and a control unit. The pod had two basic altitude operating modes: one was low level and optimized to handle recce sorties at various speeds up to 500 + knots and altitudes of between 200 feet and 6,000 feet; the other, considered medium level, was capable of sensor operation at altitudes of from 6,000' to 48,000'. Introduction of the BAC/SEPECAT *Jaguar* into the RAF inventory eclipsed the F-4's recce role and this responsibility was eventually transferred to the *Jaguar* stable.

There were a number of field modifications to RF-4's and other F-4 configurations giving them capabilities beyond those found in the stock aircraft. Among the more unusual were the following:

E-Systems—In the mid-1970's the Greenville Division of E-Systems performed the system integration, installation design, and installation of a prototype tactical ELINT system in an RF-4E aircraft for the West German Air Force. E-Systems was also responsible for the design, manufacture, qualification, and installation of a navigation interface unit that reformatted flight information from the basic aircraft navigation system for input to the ELINT system. The major task in this effort was the development of a fairing that attached to the forward camera access door and housed a 13-antenna DF array and associated DF receivers. In addition, three antennas were installed on the lower fuselage to provide supplementary signal reception. The remainder of the system remote equipment was installed in camera bays 1, 2, and 3. The system control panel was installed in the aft cockpit and interfaced with the aircraft electrical system. In addition, the Greenville Division designed, manufactured, and installed a test panel in the aircraft to simplify the interface between the ELINT system units and the ground support equipment. The design and fabrication phase of the program was accomplished at the Greenville Division's facility in Texas. Installation, checkout, and flight testing were accomplished in West Germany. It should be noted that this special mod was a prototype only and was never employed operationally.

RF-4E Bomber—Full-scale conversion of West German Air Force RF-4E's to give them full weapons delivery capability was completed by Messerschmitt-Boelkow-Blohm in Germany during 1982. All 82 then-extant WGAF RF-4E's were included in this update program. Besides incorporation of the weapons delivery system, the airplane was also given upgraded optronics equipment, an infra-red line scanner, and an advanced electronic countermeasures chaff dispensing system. Maximum load in bombs and armament for the RF-4E following conversion is approximately 5,000 pounds plus two 370 gal. external tanks.

Dynalectron—Dynalectron Corp., with headquarters in McLean, Virginia, has contracted to accommodate a number of modifications to RF-4 aircraft at the request of the USAF. Most of the modifications are in the form of updates and systems improvements. Among the many are the July, 1968 program calling for the modification of ejection seats and canopies for improved emergency egress capability (an improvement eventually integrated into all USAFE RF-4C's). This program was undertaken at Bentwater and Alconbury, England (home of the 10th TRW), and Spangdahlem and Hahn, Germany. It was successfully concluded on January 24, 1969. Also in January of 1969, Dynalectron was awarded a contract to install ECM pods and modification of Blanker on 75 RF-4C's then based in Europe. This work was successfully conducted and completed at Alconbury, England on July 7, 1970. Dynalectron continues its involvement with F-4 and RF-4 related update and improvement programs and has participated in several classified modifications, as well.

F-4X/RF-4X (F-4E(S)) Program—Understandably the most enigmatic and radical of the many recce F-4 modifications was that known as the RF-4X or later, F-4E(S) (S = Special). Actually a rather complex program consisting of several different configurations all eventually referred to under the code name of *Peace Jack*, the RF-4X reached the actual hardware stage in only one configuration, this being three modified aircraft currently serving operationally with the Israeli Air Force.

Birth of the RF-4X can be traced back to the birth of the original Central Intelligence Agency funded General Dynamics RB-57F. The key element was the General Dynamics designed and manufactured HIAC-1 high-altitude, high-resolution reconnaissance camera. Originally designed to be carried by the RB-57F during peripheral information gathering flights around hostile airspace, the HIAC-1 was a heavy, ultra-long-focal-length camera optimized for Long Range Oblique Photography (LOROP).

During the course of its RB-57F service career, HIAC-1 was steadily improved and lightened. Its weight was in fact reduced from the prototype's 3,500 lbs., to a late production model weight of 1,228 lbs.

The HIAC-1 had been designed and fabricated by the Fort Worth Division of General Dynamics. It was the end result of a total systems approach to LOROP and was characterized by simplicity of construction, versatility, and the maximum use of off-the-shelf subassemblies. General Dynamics, at the time, claimed the HIAC-1 to have the highest ground resolution of any available airborne camera. Test results had indicated the following: under laboratory conditions using high contrast Estar-base 3414 film, the predicted resolution had been 190 lines/mm; the actual resolution was 240 lines/mm. Airborne at 20 nm range, the predicted resolution had been 12.5"; actual resolution was 10". Airborne at 40 nm range, the predicted resolution had been 27"; actual resolution was 22". Airborne at 68 nm range, the predicted resolution had been 43"; the actual resolution had been 38".

The HIAC-1 design encompassed many firsts. It was, for instance, the first steppable framing camera to move as a unit (thus simplifying the task for the photointerpreter); it was the first camera with programmable computer logic for automatic stepping, focusing, image motion compensation and self-test; and it was the first camera to use a graphite composite barrel (this offering three times the tensile strength, twice the stiffness, negligible thermal expansion, .1% the thermal conductivity, and imperviousness to corrosion).

The HIAC-1's focal length was 66", its lens speed was f/4.0, the shutter speeds available were from 1/60th to 1/3000th sec., its film capacity was 1,000' on a 5" std reel, and the exposure rate was 4 frames per sec.

Israel, during the course of the RB-57F's operational recce career had, on a number of occasions, expressed strong interest in obtaining one of several RB-57F's for recce duties based on the capabilities of the HIAC-1. These requests repeatedly had been denied by the State Department on the grounds of concern for the proprietary technology involved in the HIAC-1 system.

By early 1971, the weight of the camera had been pared to the point where it was grossing at under 1,500 lbs. It thus became apparent that a transport other than the RB-57F was a distinct possibility. General Dynamics, during the course of the various HIAC-1 developments, had kept the Israelis apprised. Finally, in mid-1971, approval was granted by the State Department for sale of a pod-mounted HIAC derivative known in-house at General Dynamics as program G-139. This unit, some 22' long and having the ability to carry sensor systems weighing up to 4,000 lbs., was built up of machined bulkheads and structural members and covered with aluminum skin. The nose and tail cones were made of fiber-reinforced plastic. It was equipped with its own environmental control system.

Following a short but intense flight test program utilizing a USAF RF-4C (66-419), the first delivery of the podded HIAC took place in October of 1971. Shortly after delivery, it became apparent that the unit, though extraordinarily effective in its role, was not permitting the F-4E carrier aircraft to operate at peak efficiency. The problem was directly attributable to the pod, as the drag it created was adversely affecting the performance of the carrier aircraft. In fact, the drag factor was so high that it limited the F-4E's maximum speed to just under Mach 1.5 and its maximum altitude capability to just over 50,000'. These performance losses were quite serious as they increased exposure time to enemy anti-aircraft systems and curtailed excessive maneuvering in the event of air combat. Most importantly, the altitude restriction drastically affected the extraordinary resolving power of the HIAC's unique lens.

In January of 1972, the General Dynamics special projects section undertook an analysis of the podded G-139 problem and concluded that the solution was to increase the performance of the F-4E's General Electric J79-GE-17 turbojet engines. An in-house design effort was then initiated, this resulting in the first of several F-4X configurations.

Because of the F-4E's availability, its operational status with the Israeli Air Force, and its over-all suitability, it was decided that the F-4X modification would utilize an F-4E airframe. Modifications would include the incorporation of pre-compressor section cooling (PCC), and the addition of greatly enlarged intakes and their related system controls. Specific intake changes would include new splitter plates, new actuation components, new cowls, and new ducting. No intake structural modifications would be involved aft of fuselage station 249.

Important features of the intake design included its 2-dimensional shape, its variable geometry, and its mixed-compression concept. The intake design also featured an internal cowl with a compression surface that turned the airflow toward the engine axis and thus minimized the external cowl angle (for lower drag) and provided improved internal duct lines (for higher pressure recovery and lower distortion), variable capture area, a means of good intake/engine interfacing (with minimum induced drag) over the Mach range (allowing a proper inlet-flow-area adjustment with minimum clow lip angle for improved takeoff and low-speed performance), and a cutback sideplate (which was designed to provide an improved self-starting and maneuver capability for the inlet without imposing an intolerable loss in compression-flow-field two dimensionality and consequent over-all inlet performance). There also was accommodation for boundary layer bleed on the second ramp, cowl, and sideplates to minimize shock/boundary-layer interaction and promote self-starting. A quick-acting throat-bleed/bypass system with modulated plenum pressure control was designed for inlet self-starting. A quick acting aft bypass (just forward of the engine face) was designed to provide terminal shock position control and also to enhance the restart capability. Vortex generators incorporated in the subsonic duct were designed to promote boundary-layer attachment and thus improve overall inlet performance.

In addition to the rather extensive intake modification, the F-4X was to incorporate two large water tanks, pumps, regulators, and a means of admitting and distributing the water in the intakes. All of this equipment was to be self-contained in each of the tanks (primarily to minimize aircraft sytems integration problems). These tanks, bolted to the intersection joints of the fuselage spine and the engine nacelles, could be removed when the airplane was on the ground. Each tank had a 2,500 pound water capacity divided into three main compartments. The right hand tank emptied the forward compartment first, then aft, then center. It was expected that, because of their unique location, the water tanks' impact on the drag and stability of the F-4E would be minimized. The basic inlet and water injection modifications were expected to lead to a 1,304 pound operating weight increase over that of the stock F-4E.

Pre-compressor section cooling had been studied by the NACA in the early 1950's as a means of augmenting turbojet engine performance. One of the primary objectives of these studies was the use of existing engines at speeds above the normal engine limits determined by inlet air temperature. Approximate data for the thermodynamics of PCC were published and potential thrust improvements were recognized.

In 1957 and 1958, General Dynamics studied the application of PCC to the F-106, and tests were conducted with J57 and J75 engines in the propulsion wind tunnel at the Arnold Engineering Development Center near Tullahoma, Tennessee. The J57 engine performance data accruing from these tests indicated the need for demineralized water. Over 46 hours of maximum afterburner operation were obtained with the J75 engine, of which 40 hours were with PCC. No adverse effects on the J75 engine or engine controls were observed as a result of PCC.

In 1958, Vought installed and flight tested a PCC system on one of the two prototype F8U-3 aircraft equippped with a J75. Cancellation of the aircraft program precluded formal reporting of their results, but engineers associated with the program reported that it was very successful. The aircraft was flown to Mach 2.2 (a stability and control limit) with performance meeting expectations. No problems due to PCC were encountered with the aircraft or engine.

McDonnell, in 1962, also utilized PCC to set a number of world speed records using an early pre-production F4H-1. Maximum speed attained during these recorded runs included a short sprint out to 1,650 mph with a two-way timed record of over 1,606 mph. PCC was effective in increasing thrust, but the water injection system was extremely crude, resulting in poor evaporation effectiveness and non-uniform water distribution. Furthermore, the lack of a proper water injection system design resulted in engine damage when the compressor shroud shrunk. Water flow along the inlet walls caused the shrinkage, resulting in interference with the compressor blades. This experience confirmed for General Dynamics the need for a well-designed water injection system.

PCC refers to the use of water sprayed into an aircraft engine inlet to cool the air by evaporation *before* it enters the engine compressor. The reduced inlet air temperature has essentially the same effect on the engine as flying on an extremely cold day, i.e., engine mass flow and thrust are increased. At high altitudes, PCC begins to be effective at about Mach 1.4 and the effectiveness increases rapidly with increasing Mach number. When applied to an existing airplane, the thrust increase provided by PCC can be used either to increase acceleration and maneuverability within the existing flight envelope or to extend the flight envelope to higher speeds and altitudes.

Following additional consultations with engineers from General Electric (who, as a point of interest, were only mildly in favor of PCC), the General Dynamics special projects team concluded that PCC was a viable solution to the performance problem they were trying to overcome. the F-4X was designed around it, still with the G-139 pod hung underneath.

The Israeli Air Force had, by this time, become financially involved in the program and in fact had funded a five month study in which full-scale water injection nozzels of various types were tunnel tested. These experiments were definitive and helped General Dynamics conclude that PCC was not only feasible, but highly practical. Among its many attributes it was proven that PCC could provide engine thrust increases of well over 150 percent at altitude and speed.

Design work on the F-4X continued through the first half of 1972. Miscellaneous wind tunnel tests were conducted for purposes of defining the high-Mach intake configuration, and much additional work relating to the spray bar design was undertaken, this leading to the conclusion that water droplets in the 10 micron range were of the ideal size.

Additional General Dynamics in-house funding kept the F-4X program alive through the second half of 1972. No hardware was manufactured during this period, but significant work was completed on improved, lighter versions of the HIAC-1.

On April 12, 1973, the RF-4X proposal was officially submitted to the AF. Follow-on studies were funded shortly thereafter, these leading to additional support from the Israeli Air Force. The AF, incidentally, had been using the podded HIAC-1, under the project name of *Peace Eagle* for peripheral recce flight work in Korea, Europe, and elsewhere. The effectiveness of the system, operating in a less volatile political climate than that of the Israeli's was found to be exceptional.

By early 1974, the IAF was beginning to have strong concerns about the continued use of the HIAC-1 in podded form. The performance deficiencies were placing recce crews in ever-increasing jeopardy and an improved sensor platform was desperately needed. The Israelis had been briefed on F-4X progress and had played a key rold in its conceptual development. They had, in fact, become strong philosophical and financial supporters. Unfortunately, they were soon to run into a political wall—the US State Department found the F-4X proposal politically untenable. It was determined that the F-4X's performance placed it in an arena occupied only by the Soviet Union and the US—thus making it a warplane with significantly more potential than simply reconnaissance.

In the meantime, a definitive F-4X configuration had emerged that was tentatively referred to as the RF-4X. This airplane incorporated PCC, the shoulder-mounted water tanks, the advanced Mach 2.7 cruise intakes, and the HIAC camera; but unlike its predecessors, it made concessions to accommodate the latter in its nose. This, in effect, curtailed the use of the airplane as an interceptor. Its AN/APQ-120 AI radar system was of necessity removed, and replaced by the HIAC-1. The removal of the AI radar system satisfied the State Department's concerns and permission to sell the mod to the IAF was then granted.

In December of 1974, an IAF F-4E (69-7576), with over 300 hours of operational flying time in its log books, was delivered by a McDonnell Douglas crew to General Dynamics' Fort Worth, Texas facility for purposes of mock-up study. This airplane was used by General Dynamics for the following five months. Cardboard, tape, and the skilled hands of a number of special projects division technicians transfigured the airplane into half a full-scale mock-up of the RF-4X.

Time, politics, and an insurmountable bureaucracy finally caught up with the RF-4X program in mid-1975. Time, because the IAF needed the system as soon as possible and the RF-4X modification would have taken longer to incorporate than desired; politics because new aircraft designs such as the McDonnell Douglas F-15 were reaching the hardware stage and it was feared by Pentagon supporters that if word about the incredible performance characteristics of the RF-4X was leaked, questions might be raised concerning F-15 funding; and an insurmountable bureaucracy because the AF, in a power struggle of significant importance, strongly suggested that General Dynamics, along with certain Air Force test labs, conduct further, year-long PCC tests to confirm the safety and feasibility of the concept—something that had already been done at least a dozen times during the preceeding decade. It was, in fact, this last demand that effectively killed the program for the IAF.

Eventually, the AF quietly tabled, and then cancelled its own interest in the F-4X. In the meantime, the IAF elected to proceed, as expeditiously as possible, with a significantly less exotic variant of the RF-4X under the designation of F-4E(S). This airplane, of which three were eventually built and delivered, was simply an unmodified F-4E airframe with the HIAC camera, a vertical KS-87 camera, and related equipment mounted in a special nose. The latter provided a total of 70 cu.' of space and increased the F-4E's standard length by 12''. The new nose was equipped with its own environmental system (controlled to + or - 2-deg. C.), a liquid nitrogen system, two side oblique windows, a bottom oblique window, and numerous access doors and hinged sections.

The three F-4E(S) aircraft completed for the IAF were delivered in late 1975 and early 1976. In service, they have since proven exceptionally dependable and have provided the Israelis with a superb surveillance capability that remains on par with any similar system in the world.

The F-4X, RF-4X, and F-4E(S) were dimensionally identical to the standard F-4E with the exception of the 12'' nose extension and the associated nose cross sectional changes (beginning at nose station 77.00). The proposed F-4X had an operating weight of 33,476 lbs. a zero fuel weight of 35,669 lbs., a water weight of 5,000 lbs., and a gross weight of 58,153 lbs.

Performance of the RF-4X included a steady state cruise of Mach 2.7 (approx. 1,809 mph) at 78,000' for a minimum of 10 minutes. The time at maximum cruise speed was dictated by water consumption. Provisions for the end of the water supply were provided by sensors located in both the intakes and the water tanks. As the water supply dropped, visual indication was provided the crew in the cockpit, and automatic sensors in the intake slowly cut back on the quantity of fuel going to the engines. The latter was to provide automatic control, thus eliminating the possibility of engine damage or intake over-temp. Use of the water injection system was manually actuated by the pilot. A simple on-off switch provided all the control necessary. During a 4 minute run at maximum speed and altitude, the RF-4X was expected to cover 240 miles while photographing some 24,000 square miles. HIAC target alignment was accomplished via a special optical sight mounted on the canopy sill.

CONSTRUCTION AND SYSTEMS:

The RF-4B and RF-4C aircraft are two-place, tandem seating, supersonic, long-range, multiple sensor reconnaissance aircraft. Their primary mission is all-weather, high-low, day-night selective reconnaissance. The basic aircraft are all-metal low-wing monoplanes. The fuselage is an all-metal, semi-monocoque structure built in three sections. The forward fuselage is built of two halves so that most internal wiring can be completed before assembly. Keel and rear sections are primarily constructed of steel and titanium. The wing has a NACA 0006.4-64 (mod.) section at the root, a NACA 0004-64 (mod.) section at the wing fold line, and a NACA 0003-64 (mod.) section at the wing tip. The average wing t/c ratio is 5.1%. Incidence is 1-deg. Dihedral at the inner panels is 0-deg. and at the outer panels is 12-deg. The wing skins, with integral stiffening, are machined from aluminum panels. The wing spars are machined from forgings. The flaps and ailerons are all-metal with aluminum honeycomb trailing edges. The inset ailerons operate with down movement only. Additional roll control is provided by hydraulically actuated spoilers on each wing. The outer wing panels fold upward for aircraft storage. The wing is equipped with leading edge flaps (the inboard leading edge flap on the WGAF RF-4E's is fixed) and a boundary layer control system. BLC improves the airplane's l/d at low airspeeds by utilizing bleed air from the 17th stage of each engine compressor. This air passes through ducts along the leading edge flaps and the trailing edge flaps. Slots along the ducts behind the outboard and center panel leading edge flaps and in front of the trailing edge flaps direct laminar flow air over the wing and flaps when the flaps are extended.

The slab stabilator is a cantilever all-metal structure with 23-deg. of anhedral. It is all-moving and in most aircraft has slotted leading edges for improved low-speed stability at high aoa. Ribs and stringers are of steel. The skin is titanium. The vertical fin and rudder are of conventional steel and aluminum construction.

The cockpit is fully pressurized and equipped with a liquid oxygen system, a standard instrument panel and related sensor system controls, and conventional primary flight controls. The latter actuate their associated control surfaces through irreversible, dual power cylinders. Artificial feel systems provide simulated aerodynamic forces to the control stick and rudder pedals.

Each cockpit area is enclosed by a separate transparent, acrylic plastic, clam shell type canopy. The canopies are hinged aft of each cockpit enclosure and open approximately 53-deg. Canopy actuation is pneumatic.

Each cockpit is equipped with a single Martin-Baker MK. H7 ejection seat (standard) capable of providing the crew with emergency egress capability throughout the RF-4's flight envelope. The seat is adjustable in the cockpit vertically up or down 6''. In the event of an emergency the seat is propelled from the aircraft by an ejection gun on the back which is assisted by a rocket motor on the bottom. The ejection sequence is entirely automatic, though manual override is possible. The personnel parachute has a diameter of 28' and is contained in a hardshell container at the top of the seat.

The RF-4 is equipped with two 400 cycle, three-phase, 115/200 volt ac generators as the primary source of all electrical power. Two 100 amp transformer-rectifiers convert 115/200 volt ac to 28 volt dc. An emergency 400 cycle, three phase, 115/200 volt ac generator is provided as a limited source of electrical power if both engine driven generators become inoperative.

Hydraulic power is supplied by three, completely independent, closed center hydraulic systems. The systems have an operating pressure of 3,000 psi and are pressurized any time the engines are running. There is also a pneumatic system that provides high pressure air for the normal and emergency operation of the canopies, the ram air turbine (extension and retraction), and emergency extension of the landing gear and wing flaps.

All RF-4's are equipped with a drag chute system and an arresting hook. The drag chute is a 16' ring-slot type and is contained in the empennage. It can be used for spin recovery as well as to shorten landing roll-out. The arresting hook is a large unit mounted under the tail boom section of the aft fuselage. The hook is extended by the action of a dash pot and gravity.

The RF-4's landing gear system is a fully retractable, tricycle type. The gear is electrically controlled and hydraulically actuated by the utility hydraulic system. Accidental retraction when the aircraft is on the ground is prevented by safety switches on the main gear. As the main gear retract, the wheels are automatically braked to a stop by the anti-spin system and the struts are automatically compressed. The struts automatically return to their normally extended position during gear extension. The main gear retracts inboard and is enclosed by fairing doors that protrude slightly from the underside of the wing. All main gear doors remain open when the gear is extended. The nose gear is hydraulically retracted and extended. The nose gear retracts aft into the fuselage and is covered by mechanically operated doors that close flush with the fuselage underside. The forward door is attached to the nose gear strut. The nose gear is equipped with a combination shimmy damper and steering actuator. The limit of the nose gear steering system is 70-deg. on each side of center. Nose gear steering is electrically controlled and hydraulically actuated. The main gear are equipped with full powered brakes operated by toe action on the rudder pedals. An anti-skid system is incorporated in the normal brake system to prevent wheel skid (this is not on the RF-4B). An emergency system is provided.

The exterior lights consist of the position lights (wing and tail), join up lights (wing only), fuselage lights, anti-collision light, landing light, taxi light, inflight refueling system lights, and flood lights and electroluminescent formation lights. The exterior lighting control panel is on the right console of the front cockpit. Interior lighting is controlled from the respective cockpit.

SENSOR SYSTEMS:

The multiple sensor reconnaissance system has four types of reconnaissance sensors. They are optical, radar, infrared, and laser. The optical reconnaissance unit has day and night photographic capabilities, an in-flight film processing option, and the means to eject a film cassette. On RF-4C aircraft, 69-376 and up, the film cassette ejection capability is not provided. The radar reconnaissance unit consists of an AN/APQ-102 side looking radar (now updated w/UPD-4/6/8 systems) which has the capability of detecting both fixed and moving targets. The AN/AAS-18 infrared sensor has the capability of detecting very small heat differentials and presenting them as a pictorial display. The AN/AVD-2 laser reconnaissance set (LRS) has the capability of providing imagery comparable to an optical photograph. A sensor control panel, in the rear cockpit, permits the selection of the optical, infrared, and radar sensors. LRS controls are on the LRS control panel in the rear cockpit. Optical and laser sensors are mounted in one of three nose sensor stations. These are as follows:

Forward Station—Contains a KS-87 or KS-72 camera mounted oblique for day photography only as the basic configuration. As an alternate, the camera can be mounted vertically for day or night photography. Depression angles available are: 23.5-deg (w/6'' cone), 35.9-deg. (w/3'' cone), and 90-deg. On aircraft, 69-376, and up, the 3'' forward oblique depression angle is 43.5-deg. Image motion compensation is supplied only when the camera is mounted vertically.

Low Altitude Station—basic configuration is the installation of the KA-56 low altitude panoramic camera for day photography only. The prime alternate configuration of this section is three KS-87 cameras in a tri-camera configuration. The tri-camera array permits joint vertical and oblique day photographic capabilities. The following depression angles are available for both left and right oblique photography: 5-deg., 15-deg., 30-deg., and 37.5-deg. The 90-deg. (vertical) position is also used. An optical sight can be mounted on either side of the forward cockpit canopy to show the terrain area being photographed by the left or right side oblique cameras. The KA-1 camera (w/24'' or 36'' lens cone), in the vertical position, provides a medium to high altitude backup capability. Either the KS-72 or the KS-87 cameras with the 6'' lens cone can be mounted in the 30-deg. oblique position.

High Altitude Station—basic configuration has the KA-55A high altitude panoramic camera mounted vertically in the aircraft camera mount set LS-58A (stabilized mount) and is used for high altitude day photography. The alternate configurations consist of a mapping camera (T-11, KC-1B, or KC-1A), two split vertical cameras (w/depression angles of 71.6-deg. for the 6'' lens cone and 83.75-deg. for the 18'' lens cone), or a high altitude vertical camera. Aircraft after T.O. 1F-4(R)C-603 had the LRS installed in the high altitude station. Due to mechanical, support, and performance problems, these units were later removed from the RF-4C's so equipped and the system is not known to have been reinstalled.

RF-4's are also equipped with the following sensor system related devises:

A reconnaissance system viewfinder provides a view of the terrain underneath and ahead of the aircraft so that photographic targets can be located. The ground is viewed through the eye lens which is above the front cockpit instrument panel. The viewfinder incorporates a wide angle (60-deg.) and narrow angle (30-deg.) optical system.

An aerial photoflash cartridge ejector provides illumination for night photographic reconnaissance. On aircraft thru 71-259, there are four photoflash ejectors mounted in pairs in compartments on both sides of the upper aft fuselage behind hydraulically actuated doors. One ejector type holds 26 M112 photoflash cartridges and the other holds 10 M123 cartridges. On aircraft, 72-145, and up, one LA-429A photoflash cartridge ejector is installed in each of the upper aft fuselage compartments. Each LA-429A ejector holds 20 M185 cartridges. The M112 cartridge produces an average peak illumination of 260 million candlepower. The M185 cartridge produces an average peak illumination of 1-billion candlepower.

On aircraft thru 69-375, the ejectable film cassette may be installed in conjunction with the low altitude panoramic camera. The cassette can be ejected when the bomb button is pressed. Power is routed to an electrical relay which energizes a pneumatic actuator system causing the ejector door, beneath the camera, to open downward. Within 1.5 seconds, the door is fully open. At this point, a limit switch initiates a gas generator cartridge which initiates (1) cutting the film and mat, (2) retracting the film and mat into the cassette, (3) sealing the casette, and (4) retracting the film spool drive spindle, and then ejecting the cassette. The cassette parachute will deploy 2 seconds after ejection and a transmitter will also begin functioning to aid in cassette recovery.

RF-4C's can also be equipped with the following sensors:

Infrared Detecting Set (AN/AAS-18)—Consists of a recorder, a receiver, and a film magazine. The system provides a high resolution film map of the terrain being traversed. The receiver contains scanning optics which receive infrared energy from the area under surveillance. Two detectors maintained at -250-deg. C. by a closed-cycle cooling system receive IR energy via a system of mirrors. A 5'' CRT in the cockpit presents the WSO with a video display of the IDS imagery. The film magazine holds 250' of type SO260 film or 350' of SO2498 film.

Radar Mapping Set (AN/APQ-102)—A side looking radar (SLR) system designed to produce either or both high resolution and moving target indicator radar recce maps of the terrain on both sides or either side of the flight path. The moving target indicator modes give indication of any target with a velocity of more than 5 knots perpendicular to the flight path. The returned radar intelligence is recorded on data film and processed on a ground-based processor-correlator after the mission. The processor-correlator produces a radar map with a resolution of 50' at a constant scale of 1 to 400,000. The AN/APQ-102 has been replaced by UPD-4/6/8 SLR systems.

Other miscellaneous systems of note include: Radar Mapping Set (AN/APD-10); Radar Homing and Warning System (AN/ALR-46, and AN/ALR-50, and AN/ALQ-126); Countermeasures Receiving Set (AN/ALR-17 and AN/ALR-31); Electronic Countermeasures pods (various, including AN/ALQ-71, -72, -87, -101, -119, -131); KY-28 Speech Security Unit; QRC-353 Chaff Cartridge; Data Display Set (AN/ASQ-90); LORAN-D Tactical Navigation System (AN/ARN-92) (installed in twenty RF-4C aircraft); Communication, Navigation, Identification System (Integrated Electronic Central AN/ASQ-88B), Anti-G Suit System (delivers low pressure equipment auxiliary air to the crew suits at g-forces of 1.5 g's and above); HF Radio Set (AN/ARC-105); Electronic Altimeter Set (AN/APN-159); Automatic Flight Control System (AN/ASA-32); Inertial Navigation and Attitude-heading Reference System (AN/ASN-56); and Navigation Computer Set (AN/ASN-46A).

POWERPLANT:

The RF-4C is powered by two General Electric J79-GE-15 turbojet engines. The RF-4B is powered by two General Electric J79-GE-8B or -8C turbojet engines. These engines are lightweight (approximately 4,000 lbs. ea.), high thrust, axial-flow turbojets equipped with afterburners. Normal sea level thrust rating is 10,900 lbs. at Mil power, and 17,000 lbs. in full a/b. The J79 features variable stators (first six stages), a 17-stage compressor, a combustion chamber with 10 annular combustion liners, a three-stage turbine, a variable area exhaust nozzle, and modulated reheat thrust augmentation (afterburning). A turbine type starter, operated by air from an external power source or by the expanding gases of a solid propellant cartridge is used to crank the engines for starting. Engine bleed air, taken from the 17th stage of the compressor, is ducted to the BLC system, the cockpit air conditioning and pressurizing system, and the equipment air conditioning system. From these systems, it is further ducted to supply air to the air data computer,

SELECT TAIL MARKINGS:

Toshiki Kudo

Vertical fin markings of VMFP-3 RF-4B at Iwakuni AB, Japan in 1965. Vertical fin color is medium blue with white RF and standard Marine Corps shield coloring.

George Cockle

Vertical fin markings of Mississippi ANG RF-4C, 67-442, of the 153rd TRS/186th TRG. Scallop is emerald green with a yellow outline. Mississippi is white.

Aerofax, Inc. collection

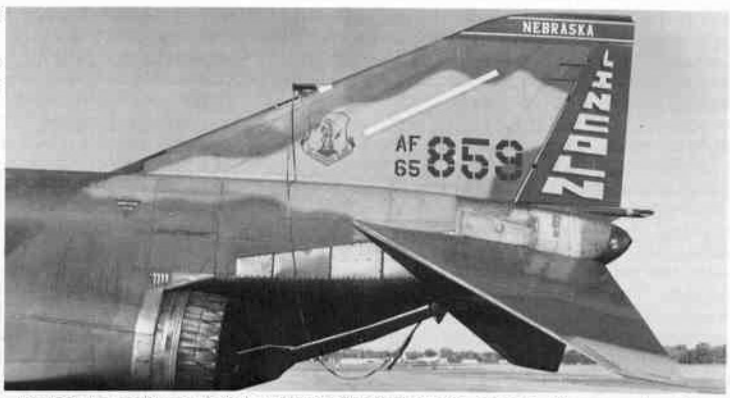
Vertical fin markings of 363rd TRW/62nd TRS RF-4C, 72-147. All lettering is white. Fin cap colors are red, white, blue, and yellow.

George Cockle

Non-standard vertical fin markings of 67th TRW/45th TRTS RF-4C, 67-455. Fin cap color is red with white dots. Note white shadow on lettering and numbers.

George Cockle

Non-standard vertical fin markings of 16th TRS/16th AMU RF-4C, 64-001. Fin cap colors are black and white. Note white shadow on lettering and numbers.



George Cockle

Vertical fin markings of 173rd TRS/155th TRG RF-4C, 65-859. Fin cap and rudder are dark green. All lettering is gold, as are fin cap cheat lines.

George Cockle

Vertical fin markings of El Toro, CA-based VMFP-3 bi-centennial RF-4B, 153093. Letter, chevron, and phantom are black. Phantom outline is white.

Jim Goodall

Non-standard vertical fin markings of 123rd TRW/165th TRS RF-4C, 64-081, following "Photo Derby '82" photo recon competition. Fin cap is yellow, as are pegasus and rudder stripes. Rudder is red.

the engine anti-icing system, the fuel tank pressurization system, the pneumatic system air compressor, and the windshield rain removal system. The engine fuel system routes fuel from the engine fuel pump to the combustion chambers, where it is discharged in the proper proportion and state of atomization for complete burning. Each engine is equipped with a completely self-contained dry sump full pressure oil system. Oil is stored in a 5.3 gal. pressurized reservoir.

There are two independent but identical air induction systems, one for each engine. The component units are fixed ramps and variable ramps, which make up the primary air system; and a variable bypass bellmouth and auxiliary air door, which make up the secondary air system. The variable duct ramp system provides primary air, at optimum subsonic velocities, to the compressor face throughout a wide range of speeds. The ramp assembly consists of a fixed forward ramp and two variable ramps. The forward variable ramp is perforated to allow boundary layer air to be bled off and exhausted overboard. The aft variable ramp is solid. The air data computer supplies a total temperature input to the ramp control amplifier which, in turn, sends a signal to a utility hydraulic servo unit to position the ramps for optimum airflow at high Mach numbers. The total temperature sensor is on the forward nose gear door. While taxiing in the exhaust envelope of an operating jet engine, the sensor can detect a temperature change which will cause the variable duct ramps to cycle. The variable bypass bellmouth is an automatic system which diverts excess air that is piling up at the compressor face into the aircraft engine compartment to help prevent compressor stalls. The variable bellmouth is a perforated ring between the intake duct structure and the engine compressor face. Between .4 and .98 Mach, the bellmouth is closed; however, a limited amount of bypass air flows into the engine compartment through the perforations in the bypass bellmouth and the engine air-oil cooler bleed. Above .98 Mach, the bypass bellmouth controller senses the optimum airflow for induction into the engine. Two auxiliary air doors, one for each engine compartment, are on the center underside of the fuselage. They are normally controlled by the landing gear handle and actuated open or closed by utility hydraulic pressure. Throttle position, nozzle position feedback, and exhaust gas temperature are utilized to schedule the correct nozzle area. A throttle for each engine is on the front and rear cockpit left console (in the RF-4B, the rear cockpit is not equipped with a throttle quadrant).

The RF-4 fuel system consists of a fuselage tank consisting of six interconnected cells (self-sealing on most a/c), and two internal wing tanks. External fuel is carried in drop tanks; two 370 gal. wing mounted units, and a single 600 gal. fuselage centerline mounted unit. All tanks may be refueled on the ground through a single pressure refueling point, or while airborne, through the air refueling receptacle mounted on the fuselage spine aft of the canopy (probe and drogue on the RF-4B). The external tanks may be individually fueled through external filler points. Fuel will not transfer from internal wing or external tanks until the airplane's weight is off the gear and the tanks are pressurized. The following is a breakdown, by block number, of individual RF-4 fuel capacities:

Total fuselage fuel (thru Blk. 40)—1,259 gal.
Total fuselage fuel (Blk. 41 and up)—1,141 gal.
Internal wing fuel (thru Blk. 40)—630 gal.
Internal wing fuel (Blk. 41 and up)—630 gal.
External wing tank fuel (thru Blk. 40)—740 gal.
External wing tank fuel (Blk. 41 and up)—740 gal.
Max. fuel load (thru Blk. 40)—3,229 gal.
Max. fuel load (Blk. 41 and up)—3,111 gal.

Fuel type required is Mil-J-5624 (JP-4/NATO F-40). Alternate fuels include Mil-J-5624 (JP-5/NATO F-44), ASTM Jet A-1, or ASTM Jet B. Oil type required is Mil-L-7808 (NATO 0-148). Hydraulic fluid type required is Mil-H-5606 (NATO H-515).

SERIAL AND BLOCK NUMBERS:

	Block #	A. F. Ser./Navy Bu. #	# Built	
RF-4B	20	151975/151977	3	
	21	151978/151979	2	
	22	151980/151981	2	
	23	151982/151983	2	
	24	153089/153094	6	
	25	153095/153100	6	
	26	153101/153107	7	
	27	153108/153115	8	
	41	157342/157346	5	
	43	157347/157351	5	
				Total 46
RF-4C	15	62-12200/12201	2	
	16	63-7740/7741	2	
	17	63-7742	1	
	18	63-7743/7749	7	
	19	63-7750/7763	14	
	20	64-997/1017	21	
	21	64-1018/1037	20	
	22	64-1038/1061	24	
	23	64-1062/1077	16	
	24	64-1078/1085, 65-818/838	29	
	25	65-839/864	26	
	26	65-865/901	37	
	27	65-902/932	31	
	28	65-933/945, 66-383/386, 66-388 (65-936/38, 65-943 to Spain and there redesignated CR.12)	18	
	29	66-387, 66-389/406	19	
	30	66-407/428	22	
	31	66-429/450	22	
	32	66-451/472	22	
	33	66-473/478, 67-428/422	21	
	34	67-443/453	11	
	35	67-454/461	8	
	36	67-462/469	8	
	37	68-546/561	14	
	38	68-562/576	15	
	39	68-577/593	17	
	40	68-594/611	18	
	41	69-349/357	9	
	42	69-358/366	9	
	43	69-367/375	9	
	44	69-376/384	9	
	48	71-248/252	5	
	49	71-253/259	7	
	51	72-145/148	4	
	52	72-149/152	4	
	53	72-153/156	4	
				Total 505
RF-4E	43	69-7448/7455 (Germany)	8	
	44	69-7456/7462 (Germany)	7	
	45	69-7463/7481 (Germany)	19	
		69-7590/7595 (Israel)	6	
	46	69-7482/7510 (Germany)	29	
	47	69-7511/7535 (Germany)	25	
	48	72-266/269 (Iran)	4	
	56	47-6901/6905 (Japan; RF-4EJ)	5	
		57-6906/6914 (Japan; RF-4EJ)	9	
	61	74-1725/1728 (Iran)	4	
	62	74-1729/1736 (Iran)	8	
	63	75-418/75-423 (Israel)	6	
	64	75-656/661 (Israel)	6	
	66	77-309/316 (Turkey)	8	
		77-357/358 (Greece)	2	
		77-1761/1766 (Greece)	6	
	68	78-751/754, 78-788, 78-854 (Iran, not del.)	6	
	69	78-855/864 (Iran, not del.)	10	
				Total 168
F-4E(S)	44	69-7567, 69-7570, 69-7576 (Israel)	3	
				Total 3

Note: Several RF-4 serial number blocks remain unidentified. It is assumed that these aircraft were either cancelled after the numbers were assigned, or that they were surreptitiously delivered to an unnamed customer. The numbers are as follows:

RF-4C	70-653/688	36
RF-4E	72-1492/1497	6
RF-4E	72-1498/1499	2
RF-4E	73-1157/1164	8
RF-4E	73-1165/1184	20
RF-4E	73-1185/1204	20
RF-4E	74-1022/1037	16
RF-4E	74-1638/1653	16
RF-4E	74-1729/1736	8
RF-4E	75-222/257	6
RF-4E	75-418/423	6
RF-4E	75-528/533	6
RF-4E	75-628/637	10
RF-4E	c/n 4966/4989	24

It is also known that the Republic of Korea has received at least 19 RF-4E's. The serial and/or production numbers of these aircraft are unknown.

SPECIFICATIONS AND PERFORMANCE:

	RF-4B	RF-4C	RF-4E
Fuselage length	62'11"	62'11"	63'0"
Wingspan	38'5"	38'5"	38'5"
Wingspan (folded)	27'7"	27'7"	27'7"
Wing area (gross)	530 sq.'	530sq.'	530 sq.'
Wing aspect ratio	2.82	2.82	2.82
Wing loading (combat)	84.1 lbs./sq.'	75.1 lbs./sq.'	76.5lbs./sq.'
Height	16'5"	16'6"	16'6"
Wheel track	17'10.5"	17'10.5"	17'10.5"
Wheel base	23'3"	23'3"	23'3"
Empty weight	31,200	30,010 lbs. 31,280 lbs. (Blk. 41 +)	31,110
Gross weight	54,800 lbs.	52,471 lbs. (blk.41 +)	52,836
Max. speed @40,000'	1,407 mph	1,459 mph	1,485 mph
Max. speed @s.l.	Mach 1.2	Mach 1.2	Mach 1.2
Combat ceiling	60,000'	59,400'	62,250'
Rate of climb	47,500'/min.	48,300'/min.	61,400'/min.
Ferry range (naut.)	1,750 mi.	1,750 mi.	1,885 mi.

AVAILABLE SCALE MODELS AND DECALS:

The following is a complete listing of all known RF-4B/C/E plastic kits and decals:

Kits

1/72nd: *IMC* (RF-4B), *Airmodel* (RF-4C conversion nose only), *Testor*, *ESCI*, *Revell*; 1/48th: *Testor*

Decals

Aero Decal: 1/48th—#27C; 1/50th—#27C
ESCI: 1/72nd—#75
Microscale: 1/72nd—72-201 (RF-4B), 72-320, 72-324, 72-369; 1/48th—48-108, 48-110, 48-143, 48-144
Model Decal: 1/72nd—#18

RF-4 VARIANTS OVERVIEW:

Norm Taylor via Dave Menard via René Francillon

Early production RF-4C, 63-7750, in light grey scheme as first delivered to the AF in mid-1965. Aircraft is thought to have been assigned to the 460th TRW/16th TRS at the time.

Steve Peltz via Dave Menard

RF-4C, 64-1000, of the 10th TRW during the course of an early deployment to Europe. Aircraft is seen in standard grey scheme with white undersurfaces. Rudder, slab stabilator tips, and radome are also white.

Steve Peltz via Dave Menard

RF-4C, 64-1016, of the 10th TRW shortly after rotating for takeoff at the start of a training mission. Fuselage call-signs were still in vogue at the time the photo was taken in 1966.

Dave Menard via René Francillon

RF-4C, 64-1080, of the 10th TRW/32nd TRS, at RAF Alconbury in August of 1967. Markings are still light grey over-all with white undersurfaces.

Aerofax, Inc. collection

RF-4C, 64-1083, of the 10th TRW/30th TRS during RAF Alconbury exercise. Color scheme is standard Vietnam camouflage with white undersurfaces. Checkerboard markings are red and white.

George Pennick

RF-4C, 68-555, of the 10th TRW/1st TRS is seen landing at RAF Wethersfield in England in July of 1983. Markings are standard wraparound Vietnam-era camouflage with low-visibility international insigne.

Paul Bennett

RF-4C, 68-553, of the 10th TRW/1st TRS taxies in following mission from RAF Alconbury in October of 1983. Markings are post-Vietnam-era wraparound camouflage with low-visibility international insigne.

Richard Ward

RF-4C, 64-000, of the 10th TRW/30th TRS is seen following mission out of RAF Alconbury. Camouflage pattern is standard Vietnam-era with white undersurfaces.

Steve Peltz via Dave Menard via René Francillon

Another view of RF-4C, 64-000, of the 10th TRW/30th TRS following landing at RAF Alconbury.

Dave Menard

RF-4C, 64-009, of the 10th TRW/30th TRS, is towed into display position for RAF Alconbury open house. Markings are standard. Fin cap checkers are thought to be red and white.

George Pennick via Dave Menard via Rene' Francillon

RF-4C, 64-1023, of the 10th TRW/32nd TRS is seen at RAF Alconbury being prepared for a mission. Camouflage and markings are standard.

George Pennick via Dave Menard via Rene' Francillon

RF-4C, 64-1060, of the 10th TRW/32nd TRS is seen returning to its hangar following mission out of RAF Alconbury.

George Cockle

Fine study of Loran-equipped RF-4C, 68-607, of the 67th TRW/12th TRS following landing and while making a transient stopover at Offutt AFB, NE.

George Cockle

Loran-equipped RF-4C, 68-595, of the 67th TRW/91st TRS during transient stopover at Offutt AFB, NE. Note travel pod being off-loaded.

Jay Miller/Aerofax, Inc.

RF-4C, 69-380, of the 67th TRW/91st TRS, with a Pave Tack pod hung from from its centerline mount. This aircraft is also equipped with the ARN-101 system.

Jay Miller/Aerofax, Inc.

RF-4C, 71-254, of the 67th TRW, sits on the runway at Bergstrom AFB, TX, immediately prior to embarking on a training mission.

Balogh via Dave Menard via Rene' Francillon

RF-4C, 64-1082, of the 67th TRW, with an unusual placement of the last four digits of the serial number in white on the vertical fin. It is presumed that this was for competition i.d.

Brian Rogers via George Cockle

RF-4C, 64-010, of the 67th TRW/45th TRTS sits transient on the ramp at Offutt AFB, NE. This camouflage pattern is presently standard for the type, though the European One scheme is rapidly overtaking it.

Don Logan via Mick Roth

RF-4C, 69-353, of the 67th TRW sits on the transient ramp at Nellis AFB, NV. Shark mouth marking is unusual for the recce configuration.

Jay Miller/Aerofax, Inc.

RF-4C, 66-476, of the 67th TRW/45th TRS, sits passively on the ramp at Bergstrom AFB, TX during the passage of a rain-bearing front.

Jay Miller/Aerofax, Inc.

RF-4C, 67-451, of the 75th TRW/91st TRS, on final to Bergstrom AFB, TX. Nose-high aoa of F-4 is one of its distinctive landing characteristics.

Peter Mancus via Rene' Francillon

RF-4C, 68-594, of the 4485th TS, Eglin AFB, FL. This is one of several RF-4s used in a variety of test programs at Eglin AFB.

Jim Sullivan via Marty Isham

Two 363rd TRW/33rd TRTS RF-4Cs, 66-4053 and 66-8580, in September of 1969, on final to Shaw AFB, SC. Note flap angle during final approach.

Jim Sullivan

RF-4C, 65-0926, of the 363rd TRW/16th TRS at Shaw AFB, SC in August of 1971. Unit patch is barely discernible on port intake cheek.

George Cockle

RF-4C, 68-578, of the 363rd TRW/16th TRS during transient stop at Offutt AFB, NE. Port drop tank still carries white paint from pre-wraparound camouflage period.

George Cockle

RF-4C, 66-435, of the 363rd TRW/62nd TRS during transient stop at Offutt AFB, NE. Unit badge can be seen on port intake cheek just above wing root leading edge.

Peter Mancus via Rene' Francillon

RF-4C, 66-460, of the 363rd TRW/18th TRS, sits on the ramp at Shaw AFB, SC. Note flare ejector doors in open position.

Rene' Francillon

RF-4C, 65-875, of the 67th TRW/10th TRS during the unit's tenure at Mountain Home AFB, ID. Camouflage paint scheme has been waxed to a gloss rather than the usual matte finish.

Rene' Francillon

RF-4C, 69-371, of the 67th TRW/22nd TRS at Mountain Home AFB, ID. Unit badge is readily visible on port intake cheek. Smaller unit marking is on nose just above nose gear.

Rene' Francillon

RF-4C, 65-927, of the 67th TRW/7th TRS. Semi-gloss paint scheme is apparent. Fin cap is green with a white lightning bolt.

George Cockle

RF-4C, 64-001, of the 16th TRS/16th AMU during transient stop at Offutt AFB, NE. Wraparound scheme is apparent as are distinctive black nose trim and vertical fin markings.

Marty Isham collection

RF-4C, 66-449, of the 432nd TRW/14th TRS, following a landing at Udorn RTAFB, Thailand mid-way through the Vietnam war. Aerial photoflash cartridge ejector unit doors are in open position.

Fred Harl collection

RF-4C, 64-1057, of the 475th TRW/16th TRS which was then operating out of Tan Son Nhut AB, Vietnam. The photo was taken in 1971 near Kunsan, Korea.

Rene' Francillon

RF-4C, 68-563 of the 86th TRW/17th TRS, Zweibrucken AB, W. Germany.

Don McGarry via George Cockle

RF-4C, 66-440, of the 18th TFW/15th TRS, Osan, Korea in March of 1982. Low visibility national insigne is apparent. Note partially painted wing drop tank.

George Pennick via Dave Menard via Rene' Francillon

RF-4C, 66-421, bearing somewhat unusual 10th TRW/30th TRS markings. Of particular interest is the Paris Airshow-related number on the starboard intake cheek. Note also location of serial number.

USAF via Marty Isham

RF-4C, 64-1051 of the 460th TRW is seen departing Ton Son Nhut AB, Vietnam in 1966 with three drop tanks (1 x 600 gal., 2 x 370 gal.).

Dave Menard via Rene' Francillon

RF-4C, 64-1077, of the 10th TRW/32nd TRS at RAF Alconbury in May of 1968. White nose radome with camouflage paint is somewhat unusual.

Chris Pocock

RF-4C, 63-7744, of the 4485th TS at Eglin AFB, FL, incorporates an unidentified nose modification which is visible as a small cap in the nose anti-glare panel.

Chris Pocock

RF-4C, 67-455, from the 3246th TW at Eglin AFB, also incorporates an unidentified nose modification. The small fairing, seen on several aircraft, is assumed to be a data link antenna.

Dave Menard

Another view of Eglin-based RF-4C, 63-7744, incorporating an unidentified pod mounted on its port wing inboard pylon. Barely discernible are non-standard pitot sensors on the nose just ahead of the windscreen.

Doug Slowiak via Dave Menard

RF-4C, 64-1004, assigned to the 6512th TS at Edwards AFB, was used as a "Streak Eagle" chase. Scheme includes a daglo orange vertical fin, conventional Vietnam-era camouflage, and white undersurfaces.

George Cockle

RF-4C, 64-041, of the 117th TRW/106th TRS, Alabama ANG. Birmingham is discernible just above the Air Guard shield on the vertical fin. Note unit patch on port intake cheek.

Peter Mancus via Rene' Francillon

RF-4C, 63-758, of the 187th TRG/160th TRS, Alabama ANG. Stenciling appears to be freshly applied and unit and ANG patches are visible on intake cheek and nose, respectively. Montgomery is visible on vertical fin cap.

George Cockle

RF-4C, 65-898, of the 124th TRG, 190th TRS, Idaho ANG is seen during a transient stopover at Offutt AFB, NE. Unit is based out of Boise, ID.

George Cockle

RF-4C, 65-918, of the 124th TRG, 190th TRS, Idaho ANG, transient at Offutt AFB, NE, wearing waxed paint rather than the usual mattte.

Fred Harl

RF-4C, 65-886, of the 183rd TRG/170th TFS, is seen in 1974 at the unit's home base in Springfield, Illinois.

Peter Mancus via Rene' Francillon

RF-4C's, including 65-852 and 64-084, of the 123rd TRW/165th TRS, Kentucky ANG, are seen at Nellis AFB, NV, during exercises in August of 1978.

George Cockle collection

RF-4C, 64-084, of the 123rd TRW/165th TRS, Kentucky ANG, is seen in Louisville, KY following the application of new low-visibility "European One" paint scheme.

Jim Goodall

RF-4C, 64-076, of the 148th TRG/179th TRS, Minnesota ANG, sits on the ramp at Duluth, MN preparatory to takeoff.

Fred Harl

RF-4C, 66-415, of the 186th TRG/153rd TRS, Mississippi ANG is seen at the unit's home base in Meridian, MS. The Mississippi and Kentucky ANG RF-4's are the only ANG RF-4's to carry a tail code.

George Cockle

Superb takeoff view of RF-4C, 65-828, of the 155th TRG/173rd TRS, Nebraska ANG illustrates gear retraction sequence and wraparound camouflage. Low visibility ANG patch on vertical fin is discernible.

George Cockle

RF-4C final approach configuration is illustrated by 65-911 of the 155th TRG/173rd TRS, Nebraska ANG. Aircraft is seen carrying a 600 gal. centerline drop tank.

George Cockle

RF-4C, 66-417, of the 155th TRG/173rd TRS, Nebraska ANG with what is almost certainly the most visible nose logo yet seen on an RF-4.

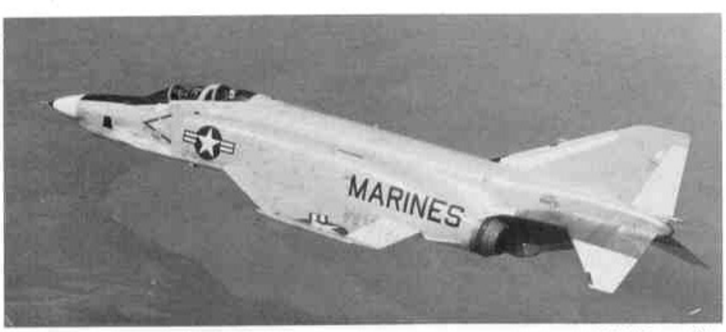
Brian Rogers

RF-4C, 64-021, of the 152nd TRG/192nd TRS, Nevada ANG, during a transient stopover at Davis-Monthan AFB, AZ. Vertical fin cap is white with blue stars.

Fred Harl

RF-4C, 64-029, of the 152nd TRW/192nd TRS, Nevada ANG, with special markings including red Reno with Blue outline on white rudder. Note also the large number 1 on the intake splitter plate.

MDD



The prototype RF-4B, 151975, is seen during an early test flight out of McDonnell's St. Louis facility. First flight took place on March 12, 1965.

Robert Dorr

RF-4B, 153110, of VMCJ-1 is seen transient at the 1st Marine Aircraft Wing facility, MCAS Iwakuni, Japan in 1973.

Dave Menard

RF-4B, 157350, of VMCJ-2, the second-to-last RF-4B built, is seen carrying two AN/ALQ-81 ECM pods on each inboard wing pylon. Extended inflight refueling boom is barely visible.

Robert Dorr

RF-4B, 153089, of VMCJ-3 is seen at its home base in El Toro, California in 1973. Extended ingress/egress ladder is noteworthy.

Rene' Francillon collection

Superb landing view of RF-4B, 153098. Vertical fin chevron is thought to be medium green with black TN.

Toshiki Kudo

Bicenteniallly-marked VMFP-3 RF-4B, 153107, seen in Japan, was one of three such RF-4B's in bicentennial markings in the Marine inventory.

George Cockle

RF-4B, 151980, of VMFP-3, is seen during transient stop at Offutt AFB, NE. Tail markings are all black with phantom accented in white. Nose anti-glare panel is non-standard.

George Cockle

RF-4B, 157350, of VMFP-3, is seen during transient stop at Offutt AFB, NE, wearing most recent low-visibility grey on grey camouflage.

Aerofax, Inc. collection

RF-4B, 157348, of the NATC, with daglo orange vertical fin and outer wing panels. RHAW system fairings are visible on the upper intake cheek, the vertical fin cap, and the drag chute compartment door.

Chris Pocock

RF-4E, 35-23, of the WGAF's AKG 52 being prepared for a practice mission. AKG 52 unit badge is visible on starboard intake cheek.

MDD

RF-4E, 35-01, of the WGAF's AKG 51 (initially assigned as a test/training aircraft to Est 61) is seen during a pre-delivery flight near St. Louis, MO. USAF serial number on vertical fin is noteworthy.

British MoD via Martin Horseman

F-4M/Phantom FGR.2, XV437, of No. 54 Sqdn. RAF carrying an EMI reconnaissance pod on its centerline mounts along with additional rocket pods, missile training pods, and actual "Skyflash" AIM's.

Chris Pocock

F-4M/Phantom FGR.2, XV469, of No. 31 Sqdn. RAF carrying an EMI reconnaissance pod on its centerline mounts. Shark mouths on the EMI pod were seen fairly often during its operational career.

MDD

RF-4E, 77-1762, of the Greek AF. Concrete shelter in background, typical of many NATO aircraft support facilities, is noteworthy.

Peter Foster via Chris Pocock

Another view of Greek AF RF-4E, 77-1762. Aircraft was in transit to Greece from the US.

MDD

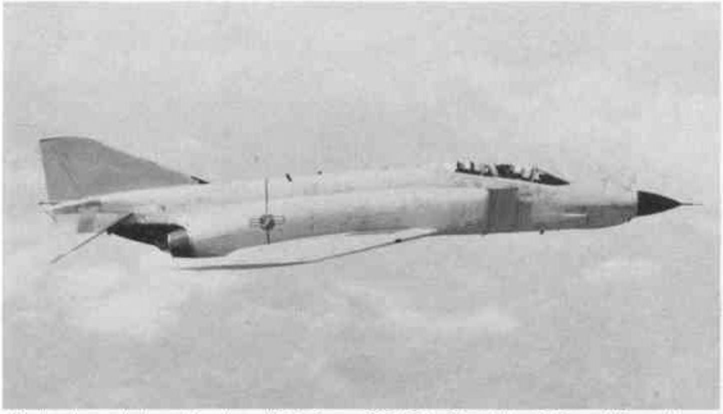
Imperial Iranian Air Force RF-4E, 74-1728, is seen during test flight out of McDonnell's St. Louis facility. Centerline store is McDonnell EROS collision avoidance transmitter/receiver.

Toshiki Kudo

Japanese Air Self Defense Force RF-4EJ, 47-6903 is seen shortly after delivery to Japan. Early grey on white scheme has since been replaced with Japanese low-visibility camouflage.

MDD

Japanese Air Self Defense Force RF-4EJ, 57-6908, in interim camouflage that has now been replaced by low-visibility scheme. Many RF-4EJ's transitioned thru 67th TRW operations at Bergstrom AFB, TX.

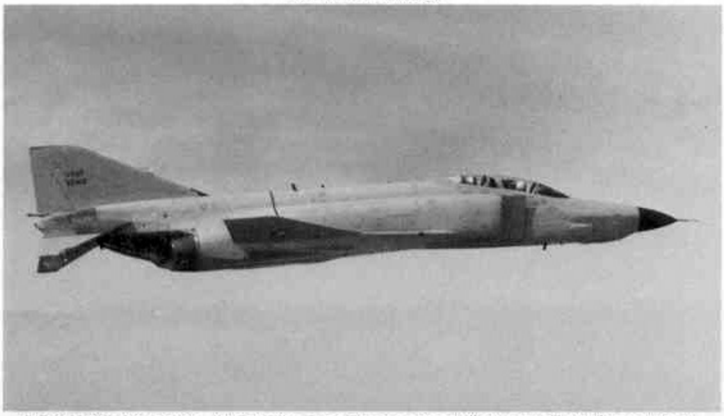


MDD

Air brush rendering of an Israeli Air Force RF-4E in Republic of Korea AF markings. Verification of RF-4E deliveries to the RKAF remains difficult though circumstantial evidence is strong.

Chris Pocock

Prior to delivery to the Israeli Air Force, RF-4E, 75-418, wearing compass ghost grey scheme is seen at Nellis AFB undergoing systems check-out and crew training. Note data link antenna under nose.



MDD

RF-4E, 75-419, of the IAF during pre-delivery check flight out of McDonnell's St. Louis facility. Most IAF RF-4E's were delivered in compass ghost grey scheme and repainted by the IAF following delivery.

E-Systems

Under "Peace Trout" a single WGAF RF-4E was modified by E-Systems of Greenville, TX to accommodate a special tactical ELINT system. The unit replaced the conventional nose-mounted optical sensors.

General Dynamics

"Peace Eagle", RF-4C, 66-419, of the 363rd TRW taking off from Carswell AFB, TX with a General Dynamics G-139 recce pod slung underneath. Designed around the HIAC-1, the G-139 could also accommodate other sensors.

General Dynamics

Full-scale mock-up of the F-4X utilized IAF F-4E, 69-7576. Visible in photo are dorsally-mounted water tanks, Mach 3.2 variable ramp inlet, and extended nose to accommodate HIAC-1 camera.

General Dynamics

First "Peace Jack" F-4E(S) is seen undergoing installation of tufts for inflight visualization of airflow around new HIAC-1 camera nose. F-4E(S) was end product of aborted F-4X program.

General Dynamics

"Peace Jack" construction area inside General Dynamics Bldg. 30 accommodated all three F-4E(S) aircraft. Third F-4E(S) can be seen in far right corner.

Robert Dorr

RF-4C, 72-153, of the 26th TRW/17TRS, Zweibrucken AB, W. Germany. This aircraft bears a ZR tail code and is seen immediately following an inflight refueling session. Visible is the open inflight refueling receptacle on the fuselage spine just behind the rear cockpit canopy fairing.

Rene' Francillon

RF-4C, 66-473, of the 363rd TRW/62nd TRS taxies in following mission during Red Flag 84-2 at Nellis AFB, NV. Aircraft is carrying a single AN/ALQ-119 ECM pod on the starboard inboard wing pylon. Noteworthy are the open flare dispenser system doors.

Toshiki Kudo

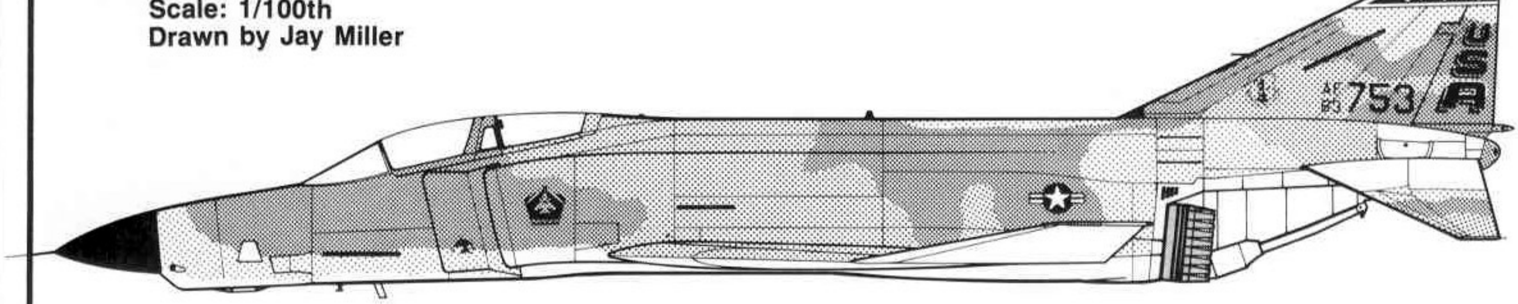
RF-4EJ, 57-6908, of the 501 Sqd. JASDF, is seen at Naha AB, Japan, wearing interim camouflage pattern that has now been replaced by a darker, more subdued scheme. Older RF-4EJ markings are discernible in the background. Note "Woody Woodpecker" on vertical fin.

Patrick Bigel via Rene' Francillon

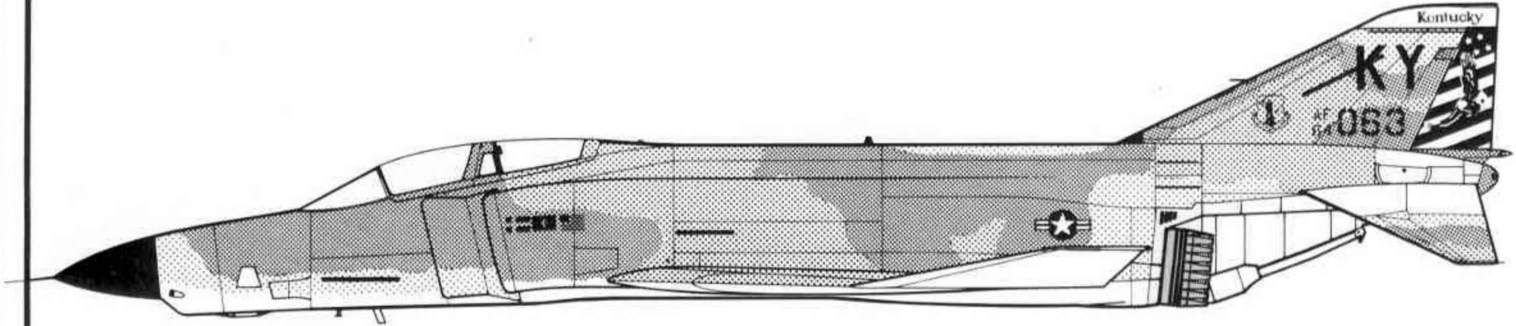
RF-4E, 35 76, of AKG 52 , is wearing special markings celebrating the 25th anniversary of AKG 52 at Lech. Unit badge is visible on vertical fin.

SELECT MARKINGS

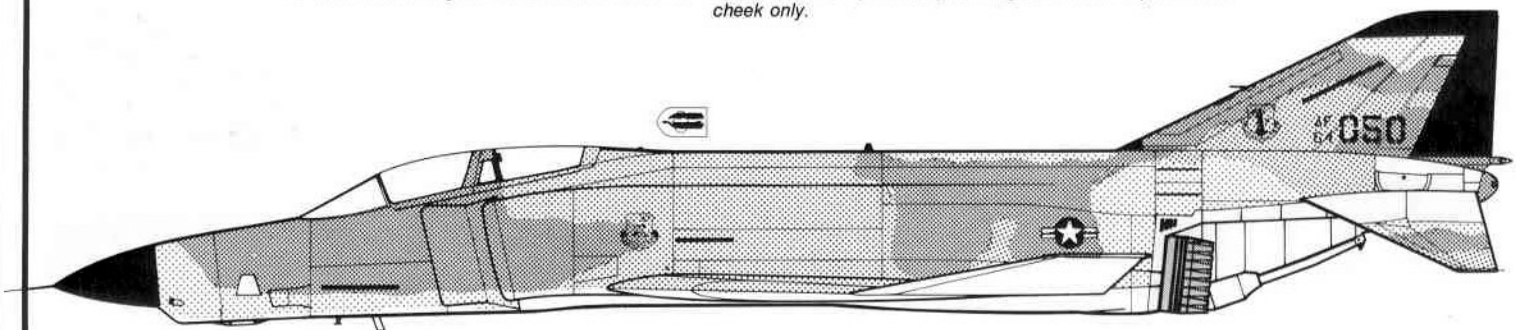
Scale: 1/100th
Drawn by Jay Miller



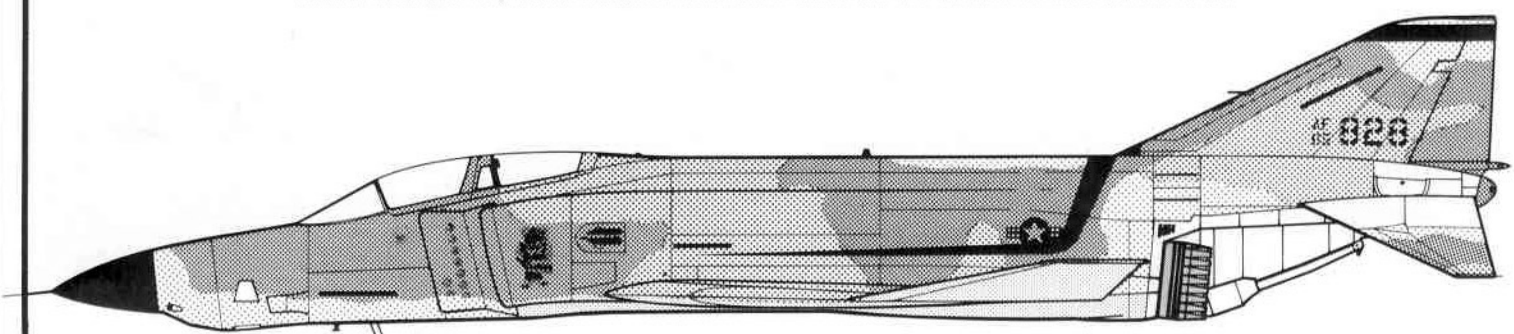
RF-4C, 63-753, of the 160th TRS/187th TRG, Alabama ANG, Montgomery, Alabama. Camouflage pattern was typical Vietnam-era with the following colors used: F.S. 30219, tan; F.S. 34079, dark green; F.S. 34102, green; and F.S. 36622, white. The radome was gloss black. The intake cheek badge is the 160th TRS unit badge, the vertical fin tip marking colors are red and white, and USA is black with a red outline. All other markings are standard for the RF-4C.



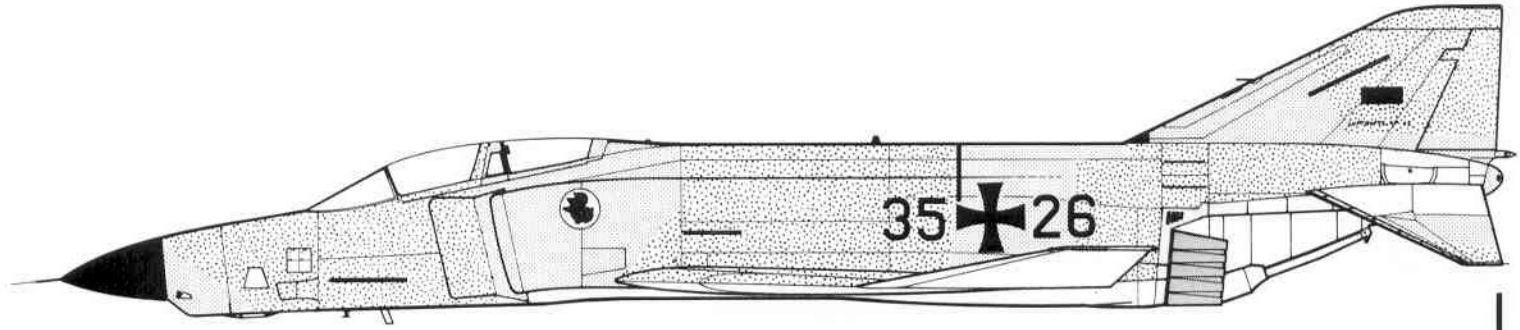
RF-4C, 64-063, of the 165th TRS/123rd TRW, Kentucky ANG, Louisville, Kentucky. Bearing a KY tail code in black, this aircraft is painted in typical Vietnam-era camouflage with the following colors being used: F.S. 30219, tan; F.S. 34079, dark green; F.S. 34102, green; and F.S. 36622, white. The nose radome was black and the vertical fin tip was white with Kentucky in black. The rudder markings consist of red and white stripes and a blue and white eagle. The stars are also white. "Best Focus '82" (Denmark) markings are seen on port intake cheek only.



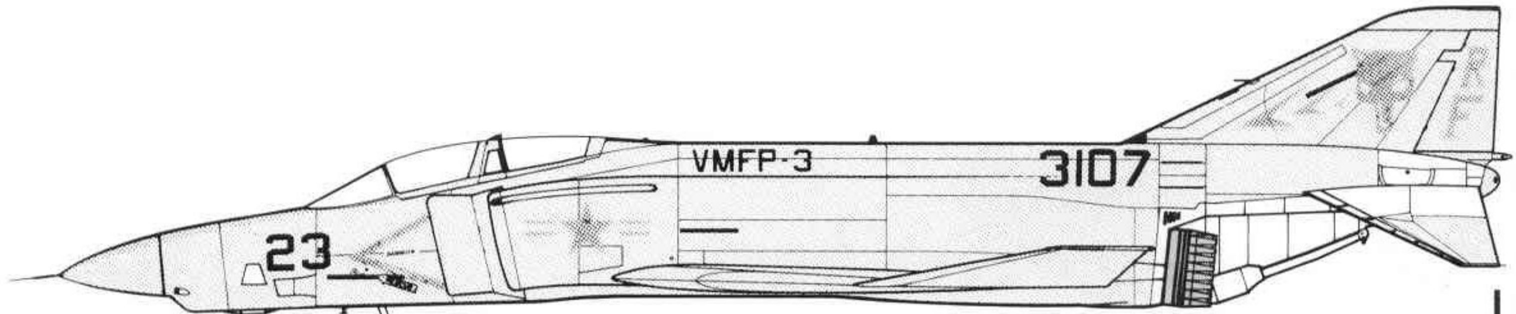
RF-4C, 64-050, of the 173rd TRS/155th TRG, Nebraska ANG, Lincoln, Nebraska. Aircraft is painted in standard Vietnam-era camouflage with the following colors being used: F.S. 30219, tan; F.S. 34079, dark green; F.S. 34102, green; and F.S. 36622, white. The vertical fin tip markings are emerald green with Nebraska and two stripes in gold. The rudder markings are also emerald green with Lincoln stylized in gold to fit the rudder design. All other markings, except for the unit patch found on the starboard intake cheek, are standard for the RF-4C.



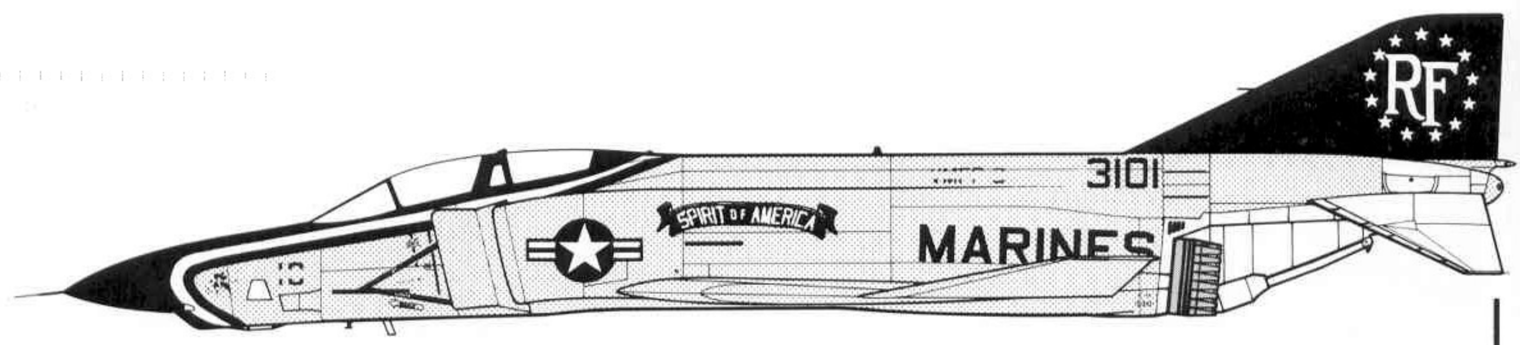
RF-4C, 65-828, of the 173rd TRS/155th TRG, Nebraska ANG, Lincoln, Nebraska. This aircraft is painted in the standard Vietnam-era camouflage with the following colors being used: F.S. 30219, tan; F.S. 34079, dark green; F.S. 34102, green; and F.S. 36622, grey/white. The saddle stripes are blue and yellow, and the fin tip band is emerald green with Nebraska in gold. The 173rd TRS unit patch is visible on the port intake cheek, as is a 1981 "Photo Finish" patch. Intake markings show Viking helmets and film canisters.



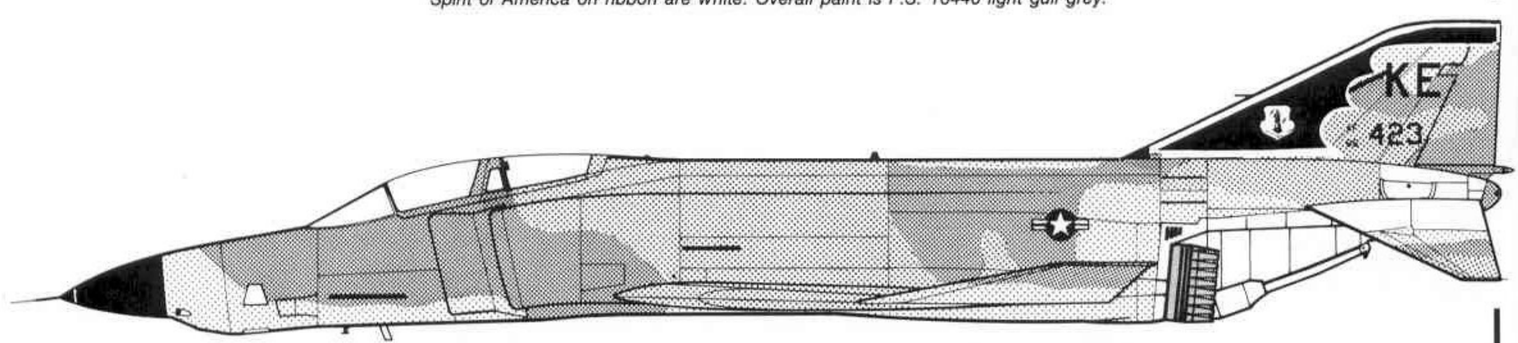
RF-4E, 35 26, of the West German Air Force's AG 51. Aircraft is painted in standard WGAF RF-4C pre-Euro-One camouflage with the following colors being used: F.S. 24064, dark green; F.S. 26152, dark grey; and F.S. 17178, silver. The radome is gloss black. Unit patches are visible on both intake cheeks. Vertical fin markings are black, red, and yellow. Fuselage lettering is black and fuselage cross and numbers are black with a white outline. Fuselage undersurfaces are white/grey.



RF-4B, 153107, of VMFP-3. Aircraft is painted in standard F.S. 36440, light gull grey. Over-all scheme is low-visibility. Wolf head and rudder code letters are medium grey. VMFP-3 and numbers 23 and 3107 are black. National insignia is also medium grey. A medium grey anti-glare panel is visible on upper surface of nose.



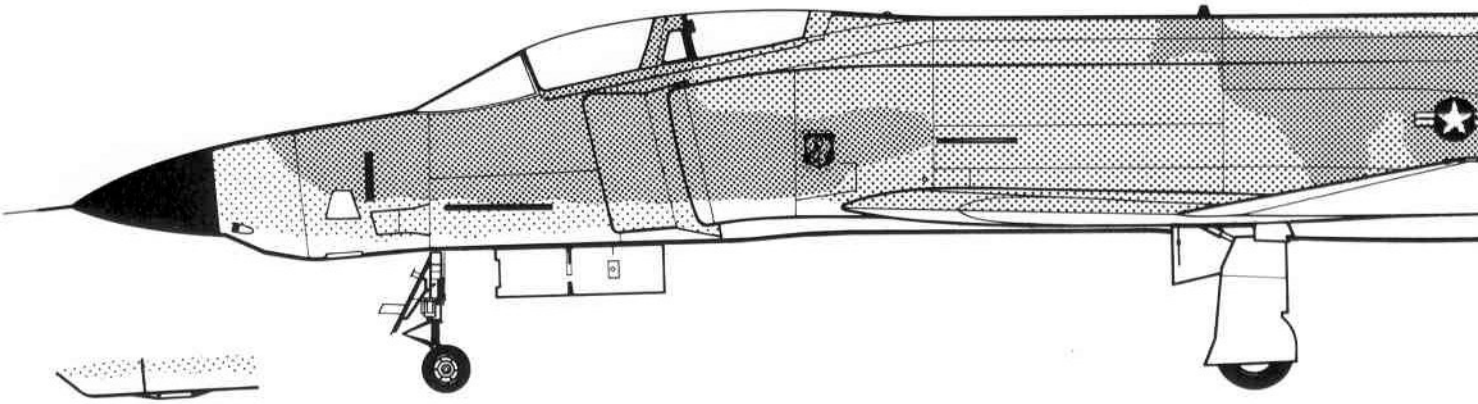
RF-4B, 153101, of VMFP-3, wearing special bicentennial markings. Nose and vertical tail colors are insignia blue. Nose trim lines are white and red, and vertical tail lettering and stars are white. Unit patch is visible on nose ahead of camera port. VMFP-3 marking on fuselage and number 10 on nose, are both red, white, and blue. Number 3101 on fuselage is black, as is Marines. Fuselage ribbon is red with a black outline, and words Spirit of America on ribbon are white. Overall paint is F.S. 16440 light gull grey.



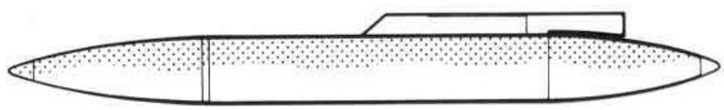
RF-4C, 66-423, of the 153rd TRS/186th TRG, Mississippi ANG, Meridian, Mississippi. Bearing a KE tail code, this aircraft is painted in a post-Vietnam-era wraparound camouflage with the following colors being used: F.S. 30219, tan; F.S. 34079, dark green; and F.S. 34102, green. The vertical fin markings consist of an emerald green scallop with yellow trim, and a white ANG patch in the center of the green. All other markings are standard for the RF-4C.

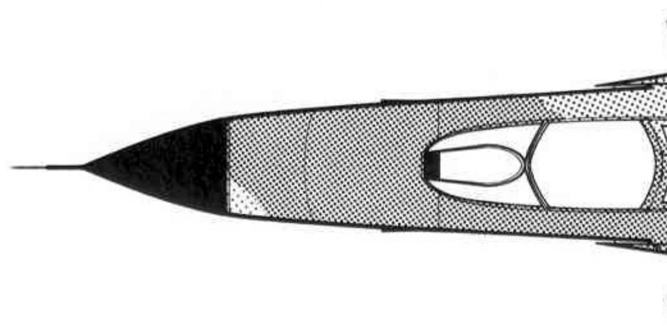
MCDONNELL RF-4C, 64-009

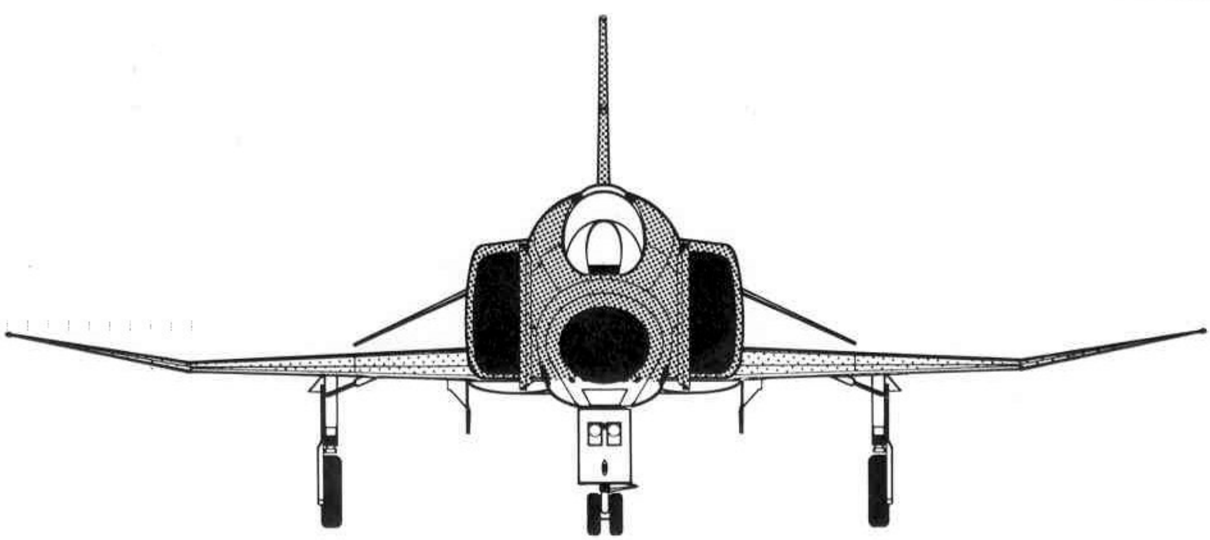
RF-4C, 64-009, of the 363rd TRW/62nd TRS, Shaw AFB, South Carolina. Aircraft is painted in standard Vietnam-era camouflage with the following colors being used: F.S. 30219, tan; F.S. 34079, dark green; F.S. 34102, green; and F.S. 36622, white/grey. The JO tail code is outlined in white with a bias towards the front of the aircraft. The fin tip markings are red, white, and yellow with a black band underneath. Five white stars are evenly spaced on the band. A TAC badge is also on the vertical fin and a 9th AF badge is on the port intake cheek. All other markings, except for black vertical nose bar, are standard for the RF-4C.

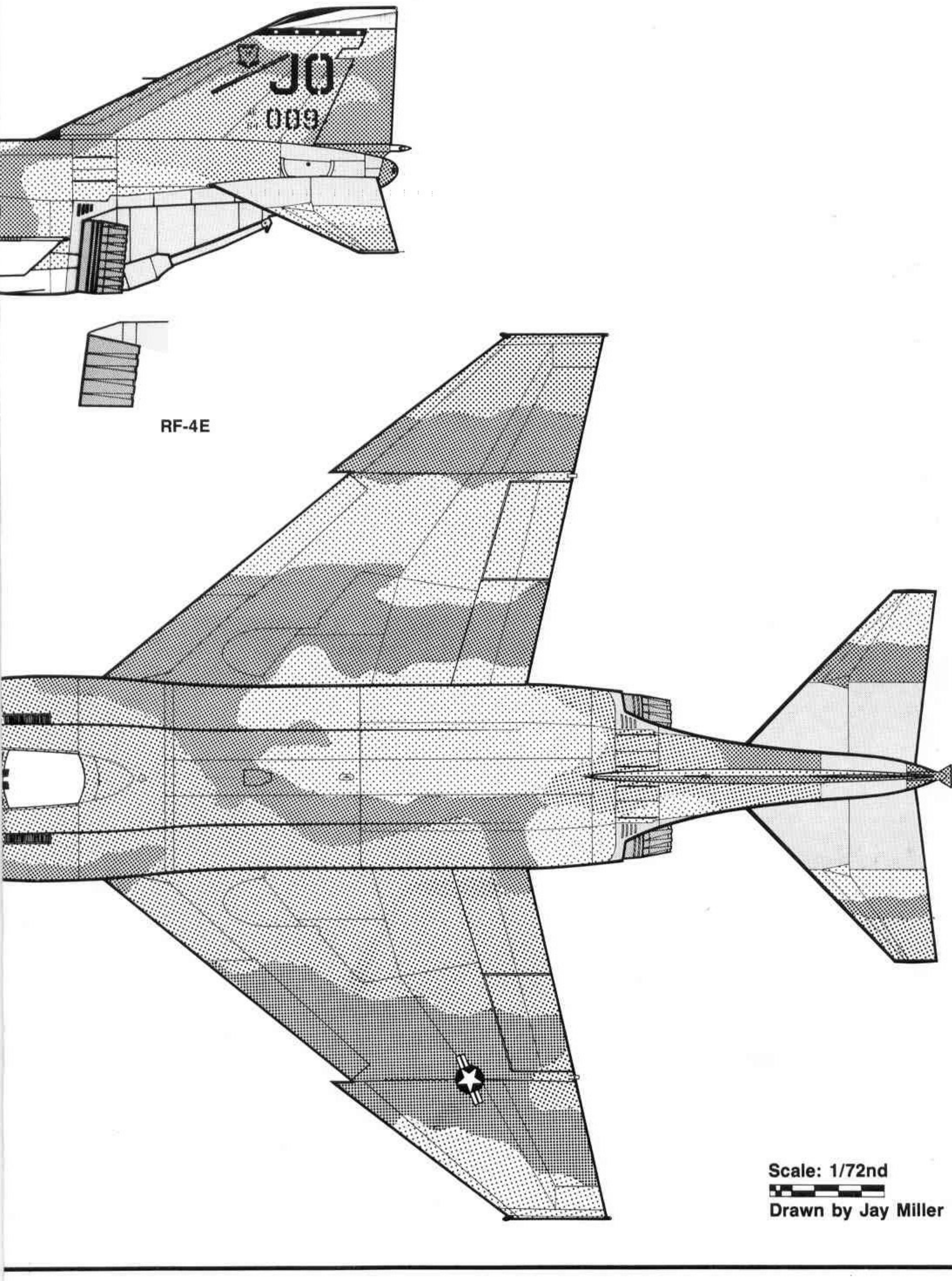


EARLY NOSE CONTOUR









Scale: 1/72nd

Drawn by Jay Miller

Al Hansen

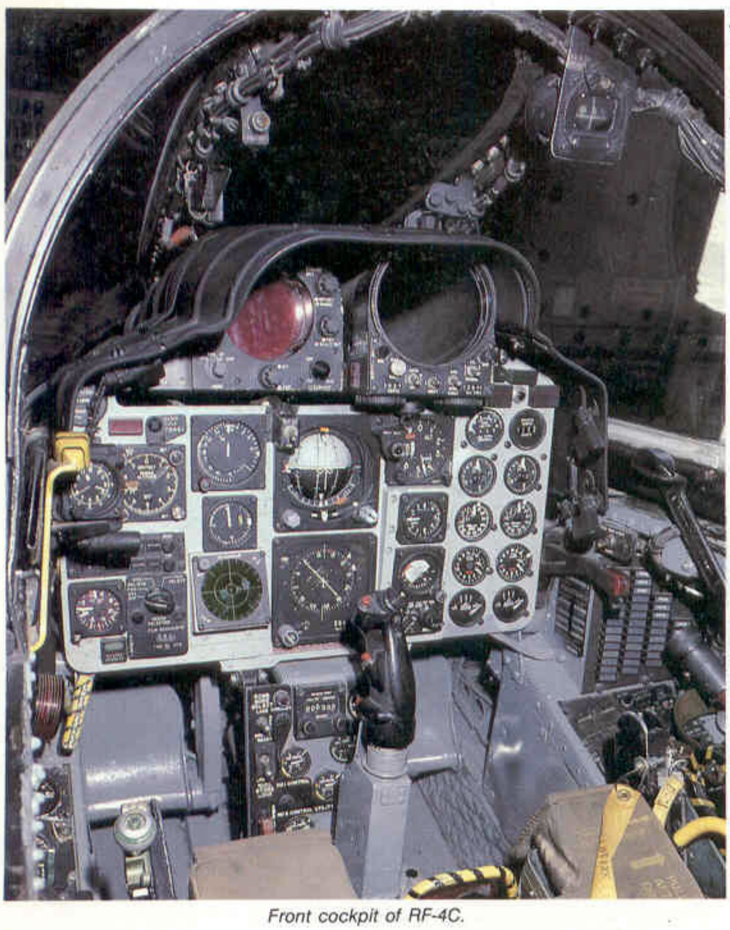
Interim low visibility camouflage is seen on RF-4B, 153095, at NAS Lemoore, CA. Later derivitives of this scheme have also made all miscellaneous markings low visibility.

Ray Stafford via Mick Roth

RF-4B, 153099, of VMCJ-3, is seen at MCAS El Toro, CA, wearing short-lived red and white dorsal markings in late 1975. A more subdued scheme followed.

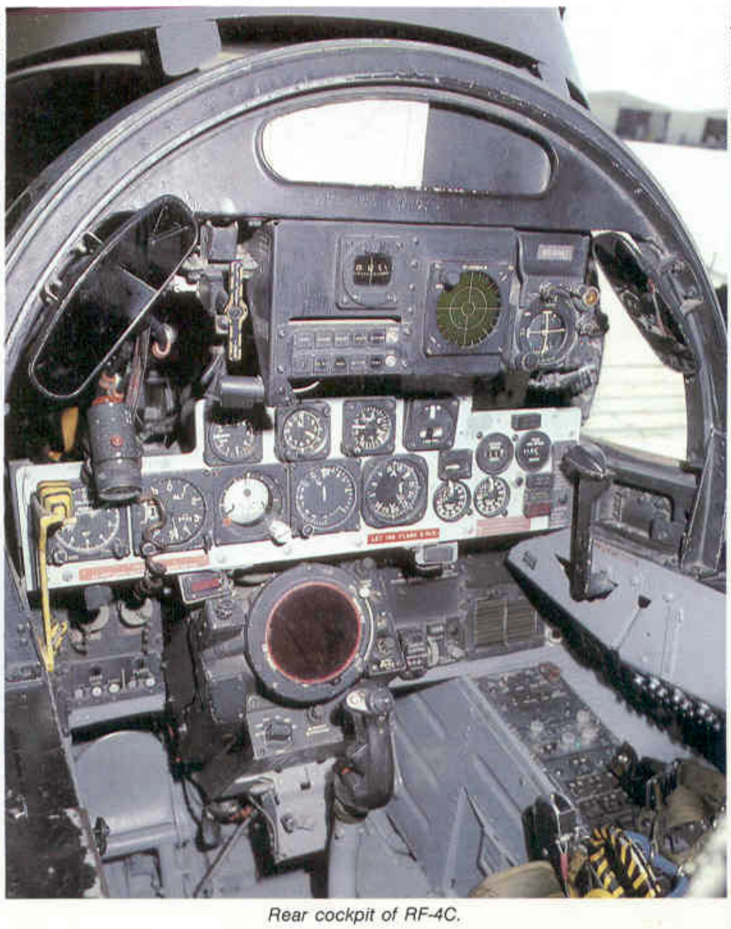
Rene' Francillon

RF-4C, 65-837, of the 165th TRS/123rd TRW, Kentucky ANG during a transient stop at NAS Fallon in July of 1982.



Jay Miller/Aerofax, Inc.

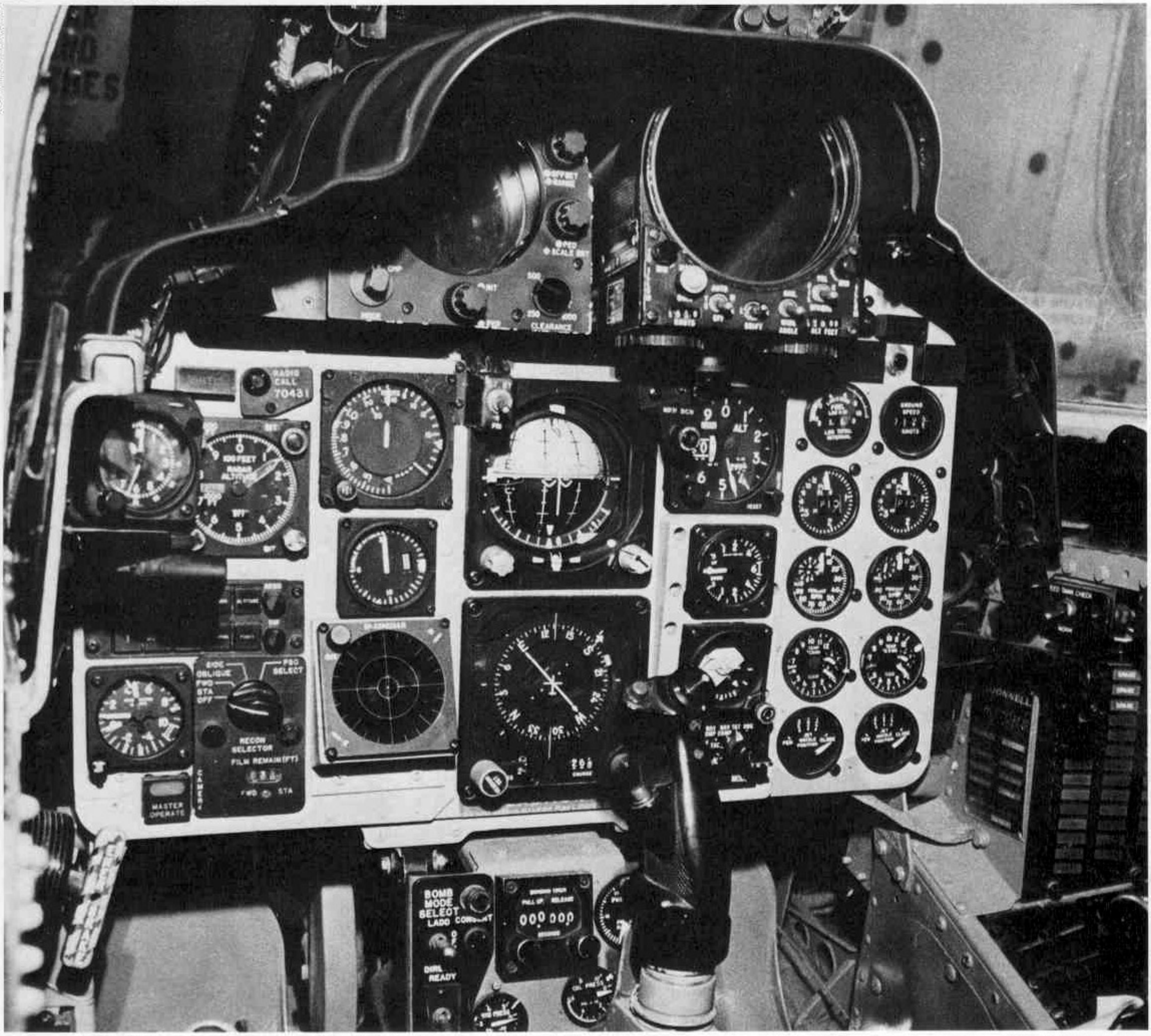
Front cockpit of RF-4C.



Jay Miller/Aerofax, Inc.

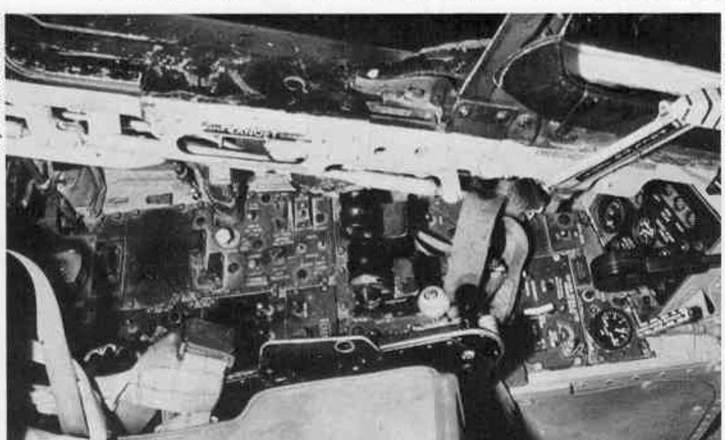
Rear cockpit of RF-4C.

Jay Miller/Aerofax, Inc.



Conventional RF-4C front cockpit accommodates standard instrument panel with flight control instrumentation, navigation data indicators, powerplant indicators, threat warning panel, and miscellaneous sensor system controls. Large round scopes at top of panel are radar on left and view finder/DSCG radar on right.

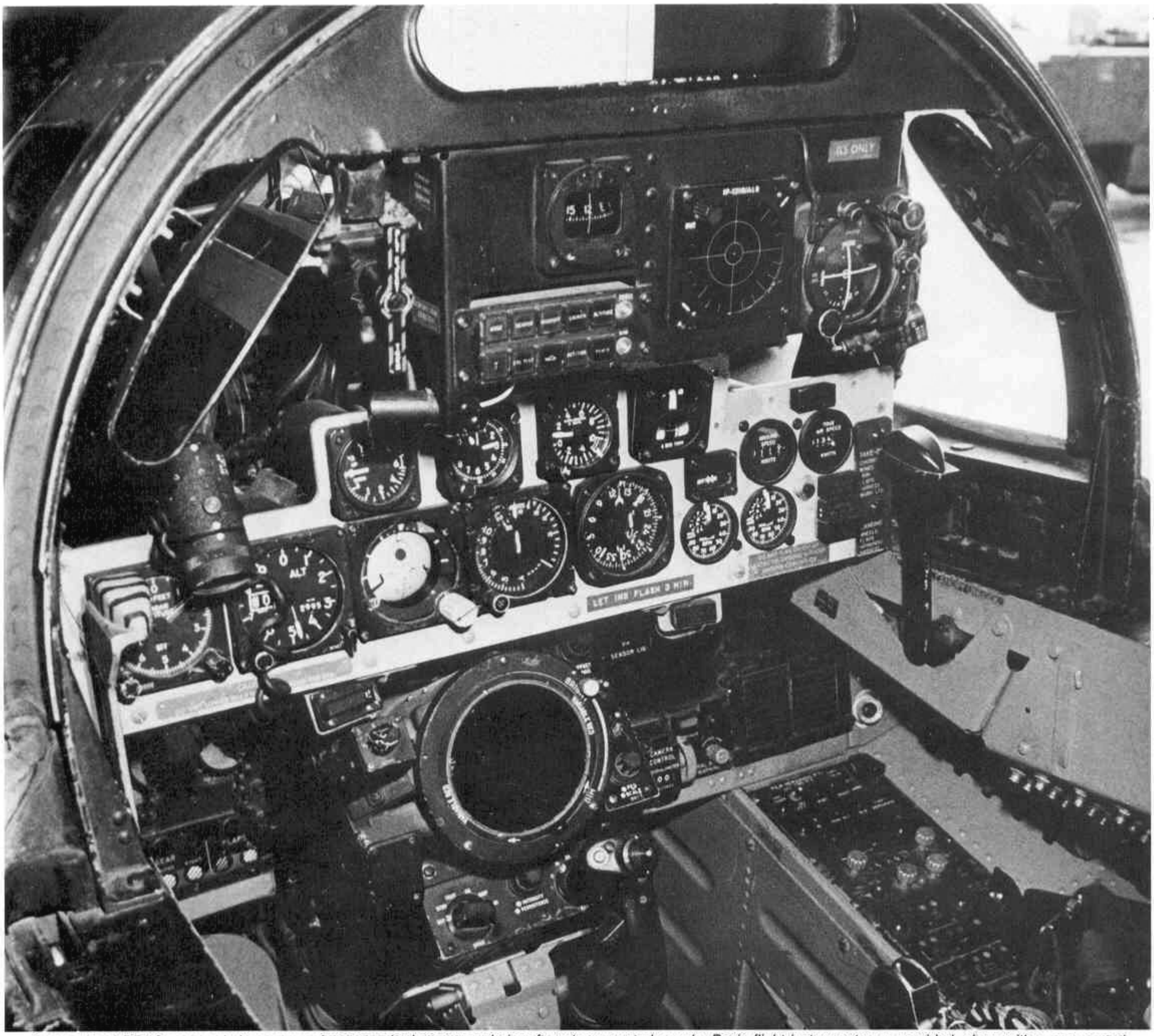
Jay Miller/Aerofax, Inc.



Front cockpit left console accommodates throttle quadrant, some fuel system controls, oxygen system regulators, and on the front console section, the landing gear indicators.

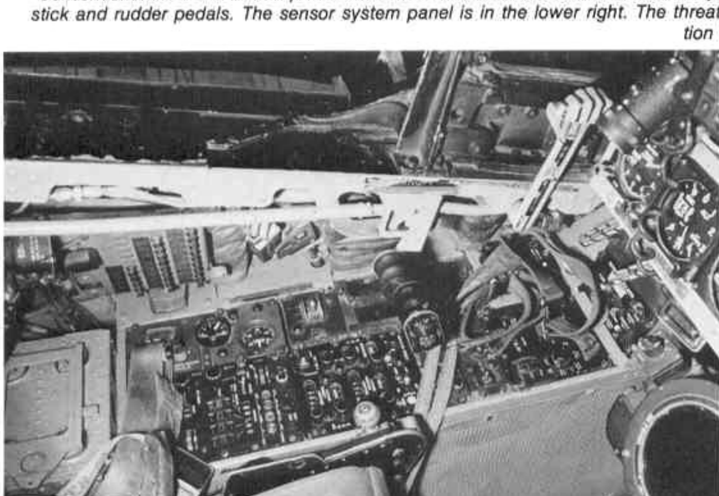
Jay Miller/Aerofax, Inc.

Front cockpit right console accommodates communications equipment, the lighting controls, the right sub panel with warning lights, and the oxygen system connectors.



Jay Miller/Aerofax, Inc.

Conventional RF-4C rear cockpit accommodates standard sensor and aircraft systems control panels. Basic flight instruments are provided, along with a rear control stick and rudder pedals. The sensor system panel is in the lower right. The threat warning panel is in the upper right. Rear view mirrors permit rear quadrant observation in flight.



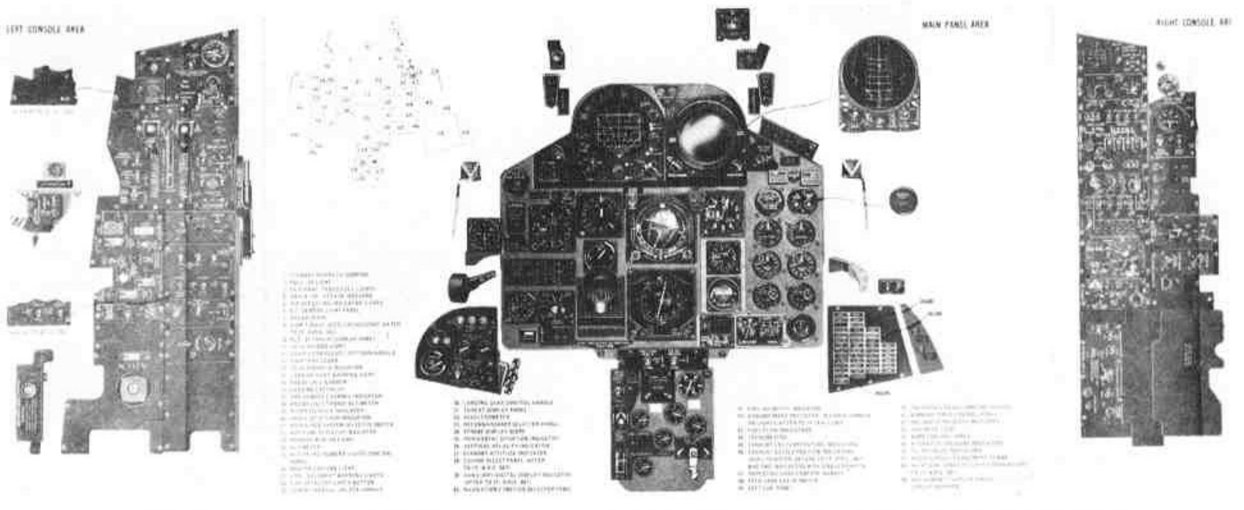
Jay Miller/Aerofax, Inc.

Rear cockpit left console accomodates throttle quadrant, radio/navigation panels, circuit breakers, and a sensor control panel.

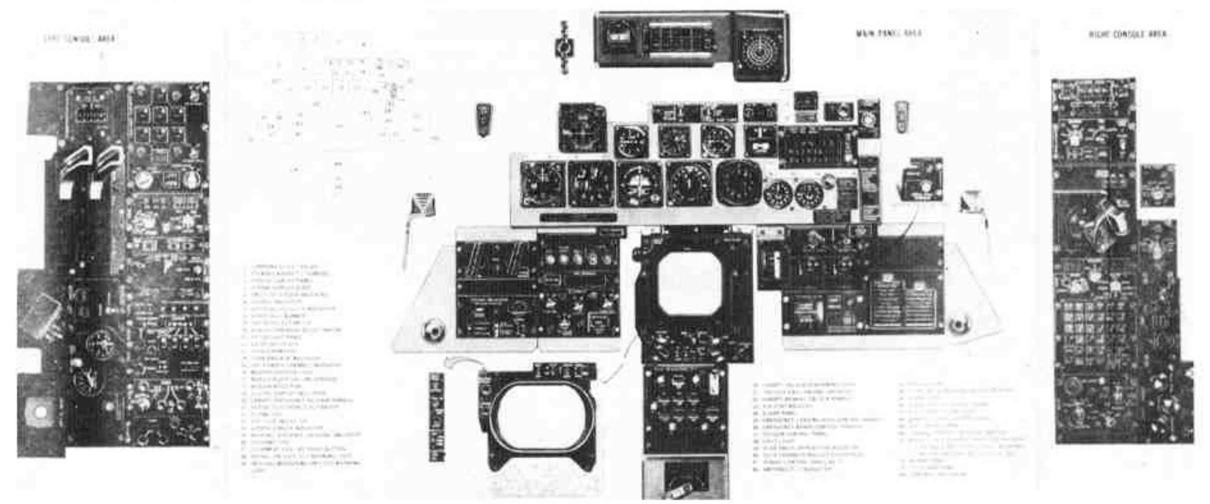
Jay Miller/Aerofax, Inc.

Rear cockpit right console accommodates the laser control unit panel, the Pave Tack panel, the integrated hand control, the SLR control panel, cockpit lighting, and the IR control indicator.

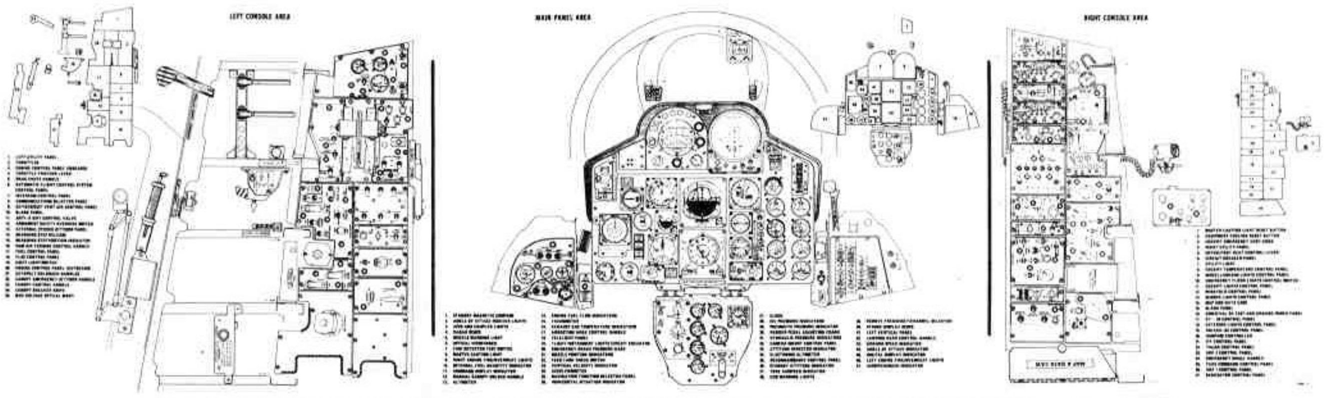
RF-4C FRONT COCKPIT



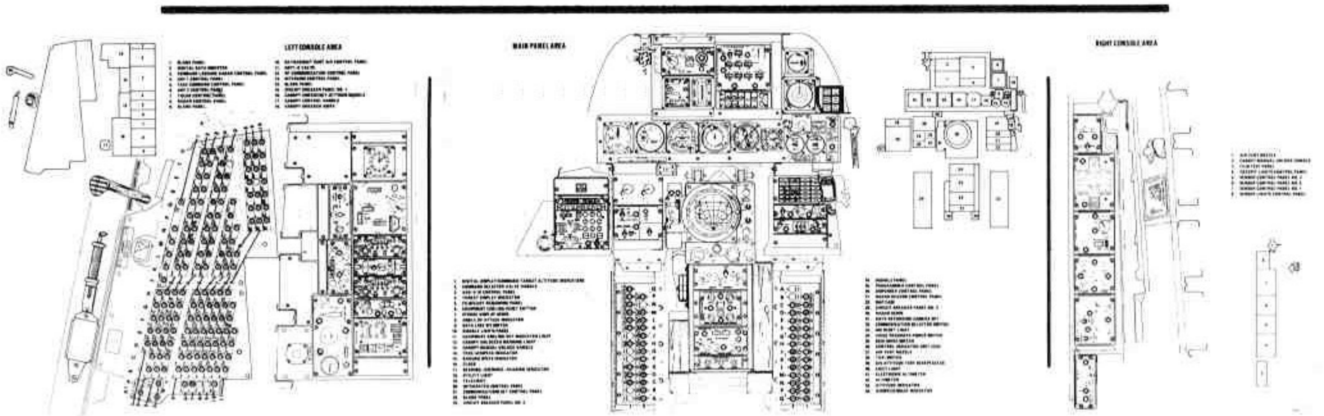
RF-4C REAR COCKPIT

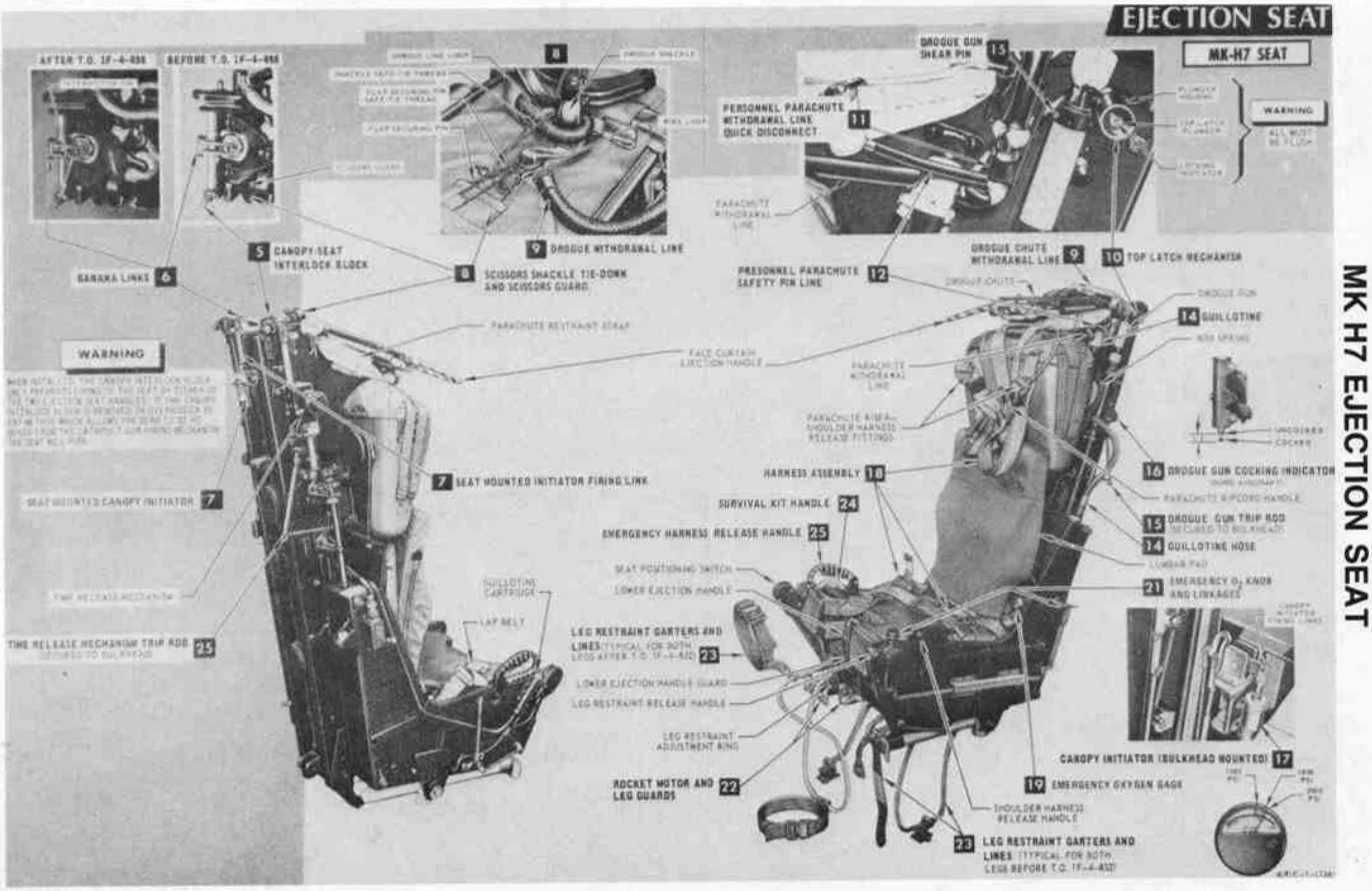


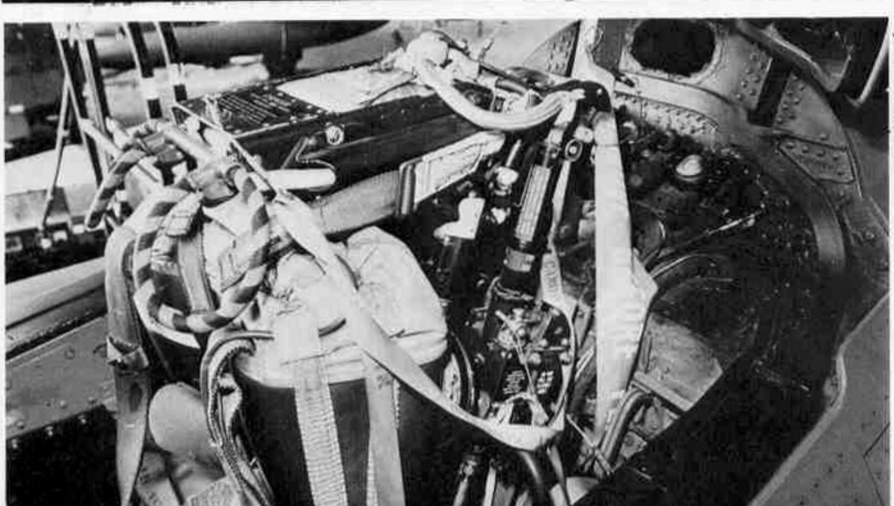
RF-4B FRONT COCKPIT



RF-4B REAR COCKPIT





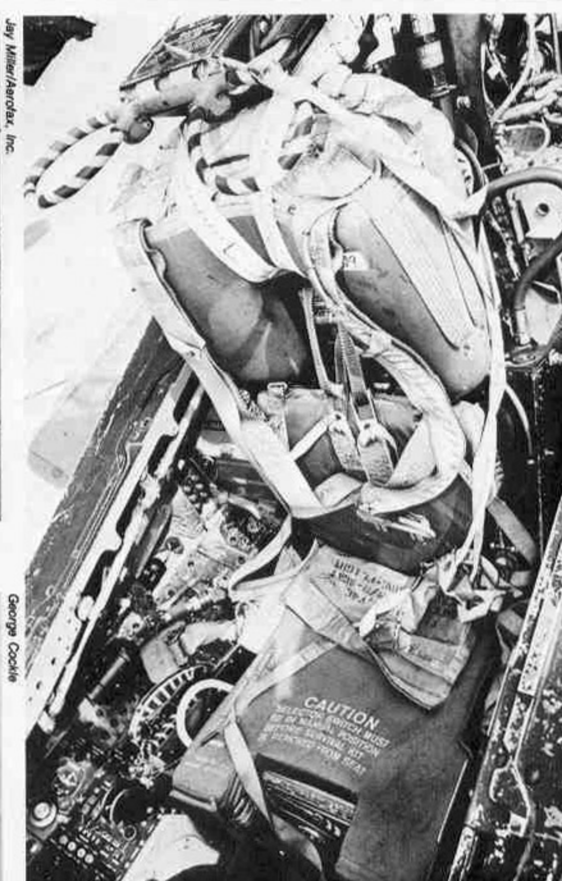


Jay Miller/Aerofax, Inc.

Headrest area at top of ejection seat and behind it accommodates personnel parachute, ejection seat actuation grips, and cockpit bulkhead. Pressure seal rim along cockpit coaming is notable.

George Cockle

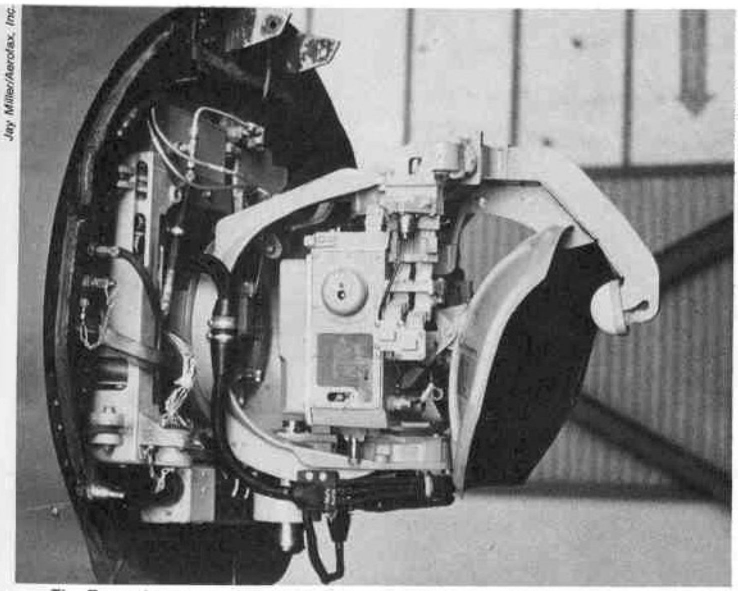
Canopies are electro-hydraulically opened and closed. Rear canopy mounts two external mirrors on canopy frame for rear observation.



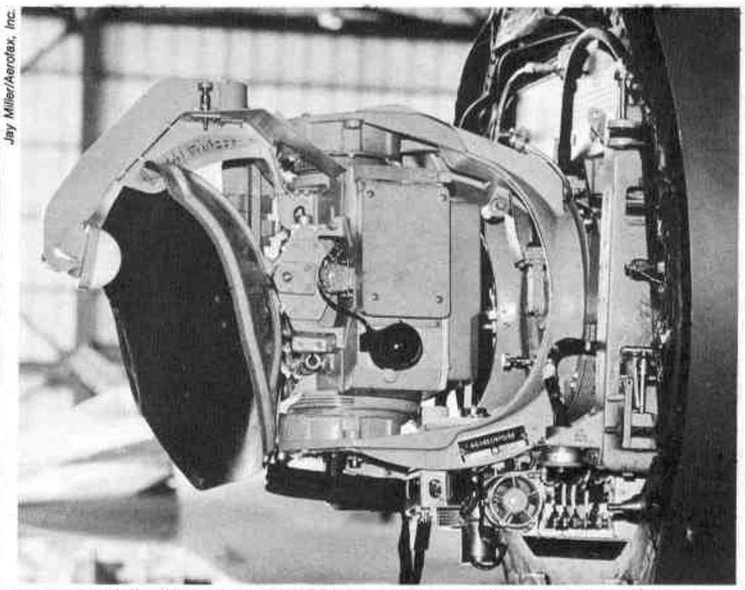
Jay Miller/Aerofax, Inc.

MK H7 ejection seat can be actuated using either overhead pull rings or side-mounted handles. Seat has zero-zero capability.

Jay Miller/Aerofax, Inc.

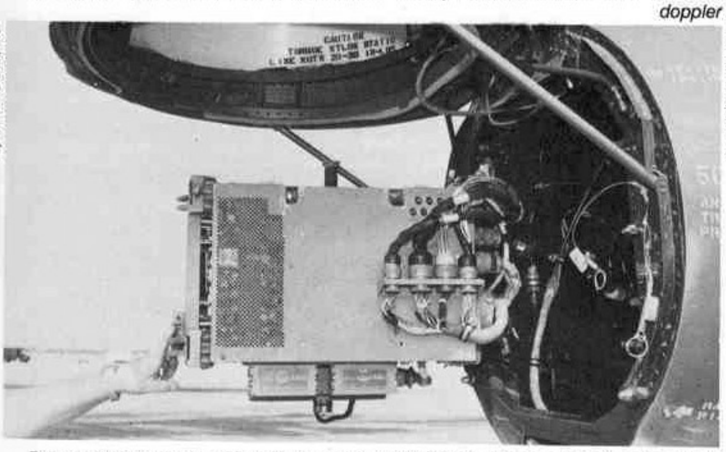


Jay Miller/Aerofax, Inc.

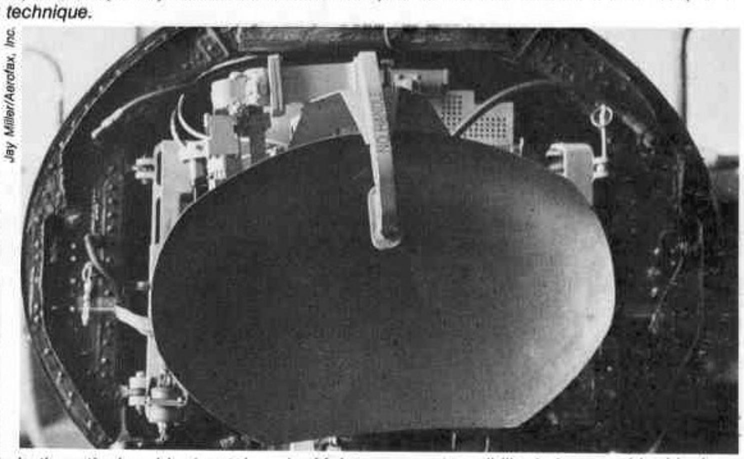


The Texas Instruments AN/APQ-99 is a relatively short range forward looking radar system optimized for use at low altitudes and in all weather conditions. There are now plans to replace the system in all RF-4C's by the end of this decade with an improved capability radar. The AN/APQ-99 operates in J-band and utilizes a two-pole doppler technique.

Jay Miller/Aerofax, Inc.

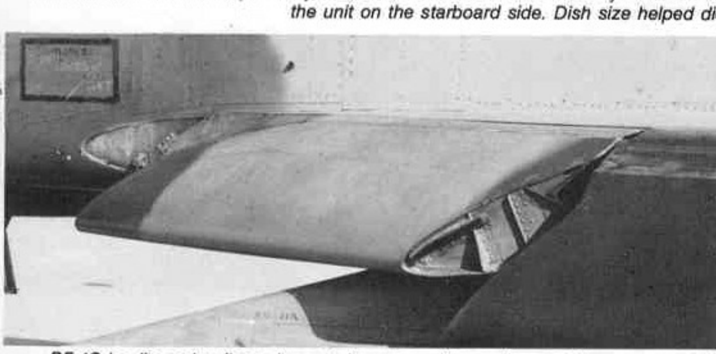


Jay Miller/Aerofax, Inc.



Rear and front views, respectively, of the AN/APQ-99. Antenna is fully articulated in both vertical and horizontal mode. Maintenance accessibility is improved by hinging the unit on the starboard side. Dish size helped dictate RF-4C's nose radome diameter and configuration.

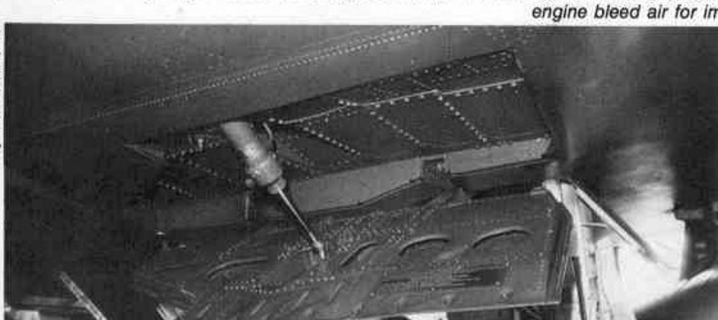
George Cockle



George Cockle

RF-4C leading edge flaps droop to increase wing camber and improve control at low airspeeds. Outer panel leading edge flaps incorporate high-pressure blowing system using engine bleed air to improve lift and control. Some RF-4E's have leading edge flaps and others have fixed leading edge slats. The latter do not utilize engine bleed air for improved lift characteristics.

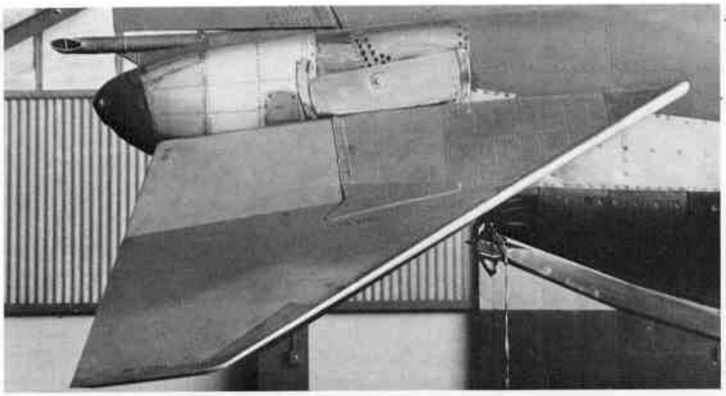
Jay Miller/Aerofax, Inc.



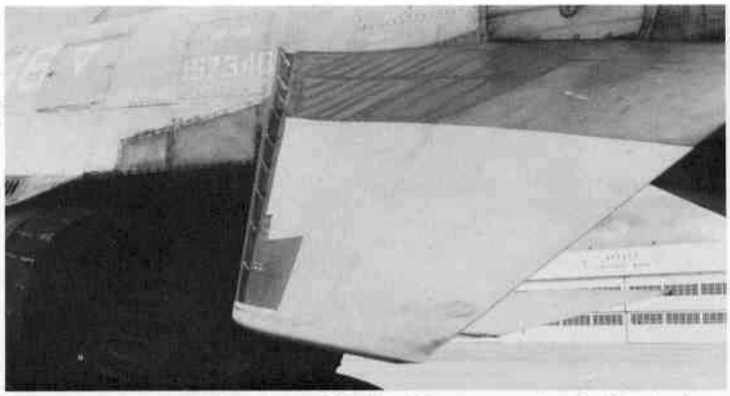
Inboard (shown) and outboard wing flap sections are different designs. The inboard flap is a conventional split-type. The outboard flap is a modified slotted flap w/BLC.

Jay Miller/Aerofax, Inc.

Roll control in the RF-4C is accomplished through the use of small ailerons on the wing inboard section trailing edge, and spoilers. Use of either or both units is dictated automatically by airspeed.

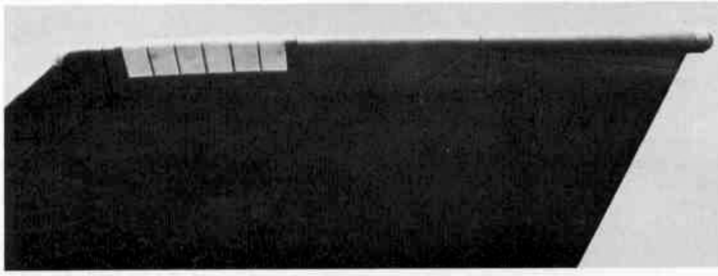


Jay Miller/Aerofax, Inc.



George Cockle

RF-4C (l.) and RF-4B (rt.) slab stabilators are all-moving hydraulically-actuated units with reverse camber. RF-4B and most RF-4E stabilators are equipped with a leading edge slot to improve pitch control at low airspeeds. Inboard sections are of titanium construction to accommodate exhaust plume of J79's.



Jay Miller/Aerofax, Inc.

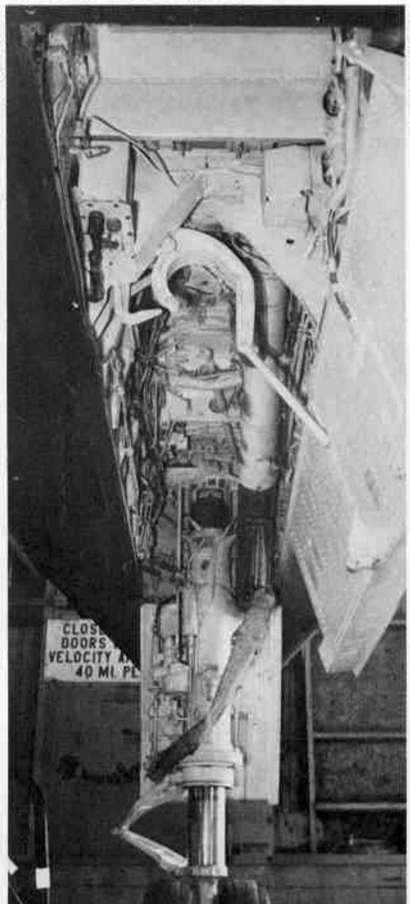
Wingtip accommodates tape lights for night flying, conventional night lights, and at the forward end, one of several RHAW antennas.

Jay Miller/Aerofax, Inc.

Inboard wing pylon usually accomodates ECM pod. Outboard wing attachment points are normally used for wing drop tank transport. It is possible for the RF-4C to carry conventional iron bombs at these points.

Jay Miller/Aerofax, Inc.

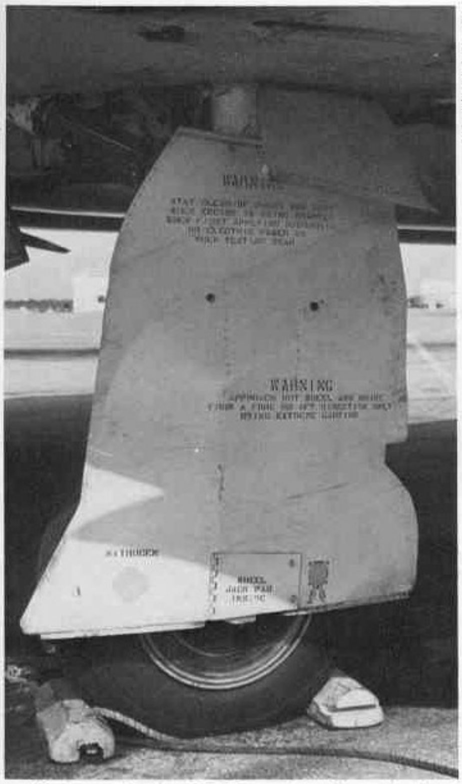
Jay Miller/Aerofax, Inc.



Jay Miller/Aerofax, Inc.

Nose gear for the RF-4C is a dual wheel unit with 18 x 5.5 14-ply tires. It is hydraulically steerable using the cockpit rudder pedals. Retraction and extension are also hydraulically actuated. Gear well door details differ somewhat from RF-4 model to model. Marine Corps RF-4B's have a single taxi and landing light mounted in the nose gear door rather than the RF-4C's dual light unit.

Jay Miller/Aerofax, Inc.

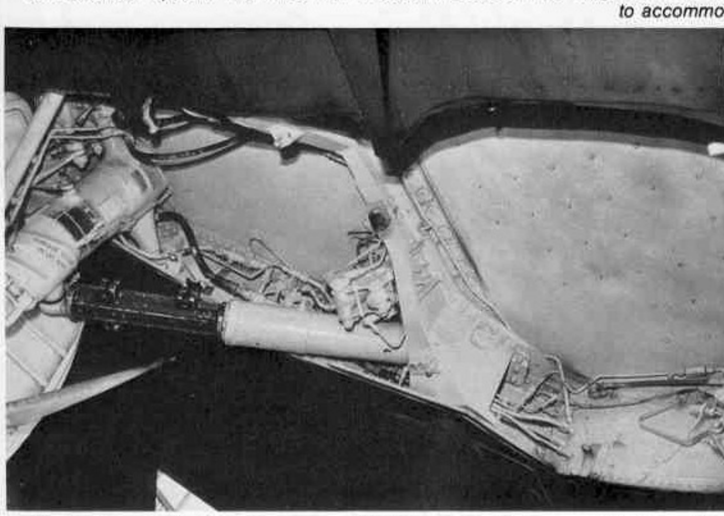


Jay Miller/Aerofax, Inc.

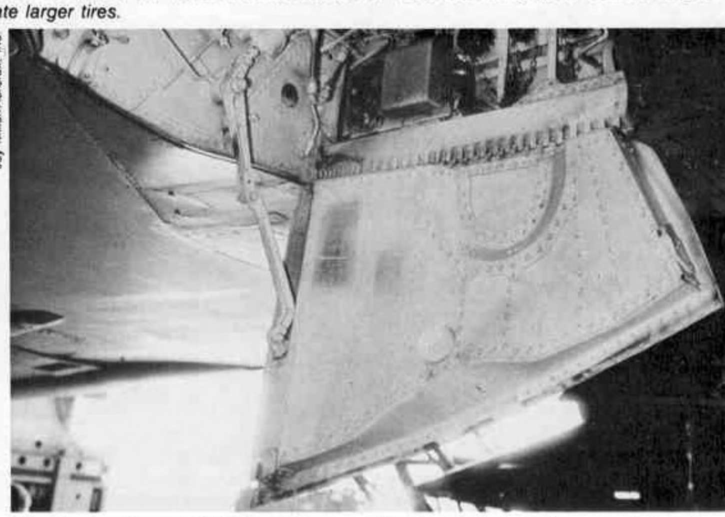
Jay Miller/Aerofax, Inc.

Main gear for the RF-4C consists of two single wheel units with 30 x 11.50-14.5 24-ply tires. They are each equipped with disc-type brakes and a hydraulic retraction and extension system. The wheel well is accommodated in the wings between wheel fuel cells. AF RF-4C's and some USMC RF-4B's have wing upper surface bulges to accommodate larger tires.

Jay Miller/Aerofax, Inc.

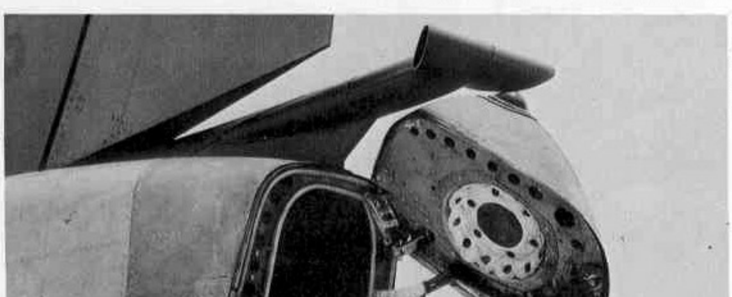


Jay Miller/Aerofax, Inc.



The main gear wheel well is recessed into the wing and is covered by three doors when the gear is retracted. Two doors are directly attached to the gear strut and a third door is attached to the wheel well. All three doors are mechanically or hydraulically actuated.

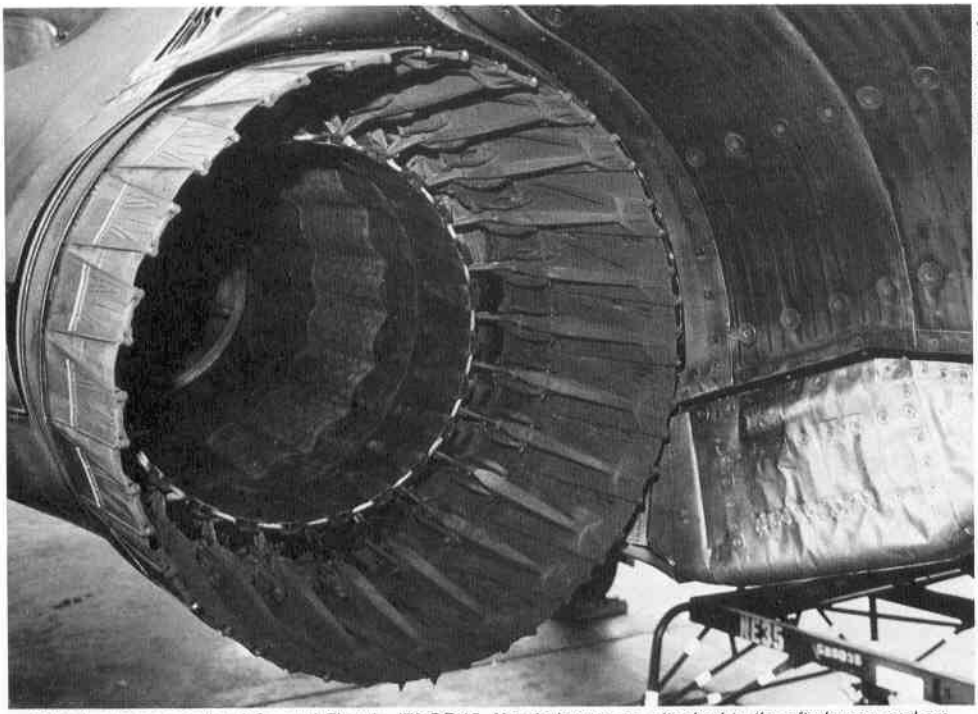
Jay Miller/Aerofax, Inc.



The RF-4C's drag chute compartment is covered by the hinged tail cone which, in turn, accommodates several of the aircraft RHAW antennas. Mounted just above the tail cone is the emergency fuel dump tube.

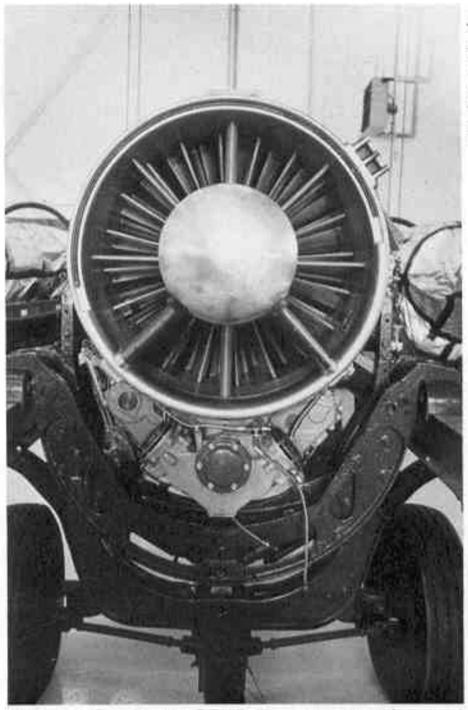
George Cockle

The drag chute is a prepackaged unit that is designed to slide easily into the F-4's drag chute compartment. Most F-4 landings require use of the drag chute.



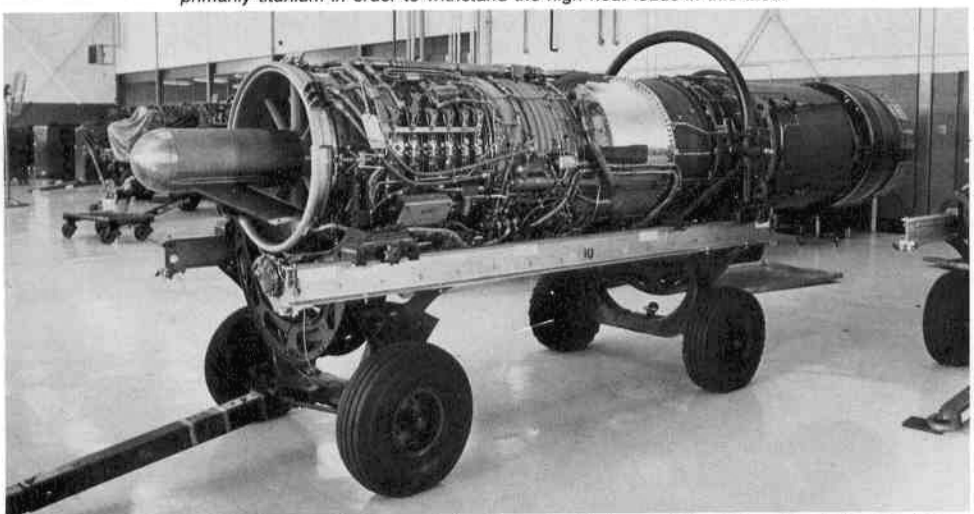
Jay Miller/Aerofax, Inc.

Dilated exhaust nozzle of General Electric J79-GE-15. Nozzle leaves are attached to the afterburner and are hydraulically actuated by a series of rams located around the afterburner's periphery. Empennage section skin is primarily titanium in order to withstand the high heat loads in this area.



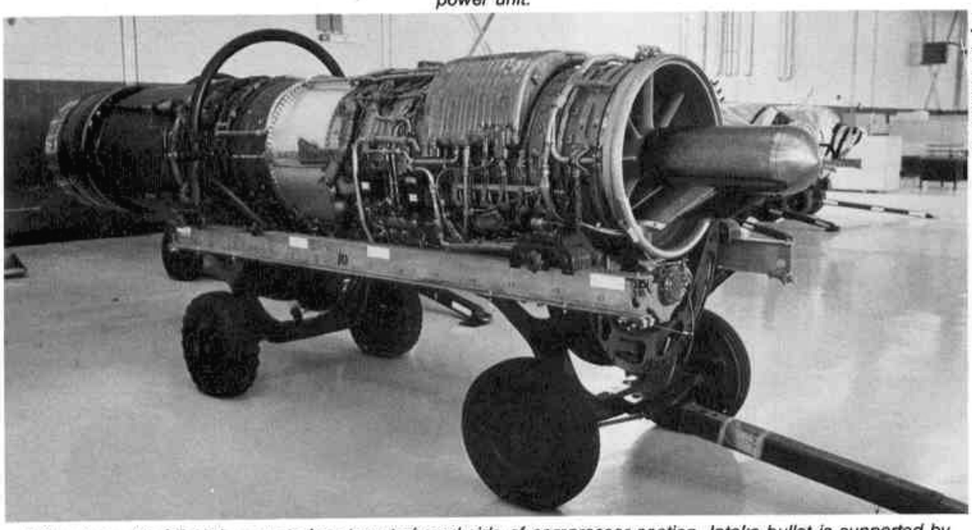
Jay Miller/Aerofax, Inc.

General Electric J79-GE-15 compressor section contains variable stator blades. Accessory unit is mounted underneath forward engine section.



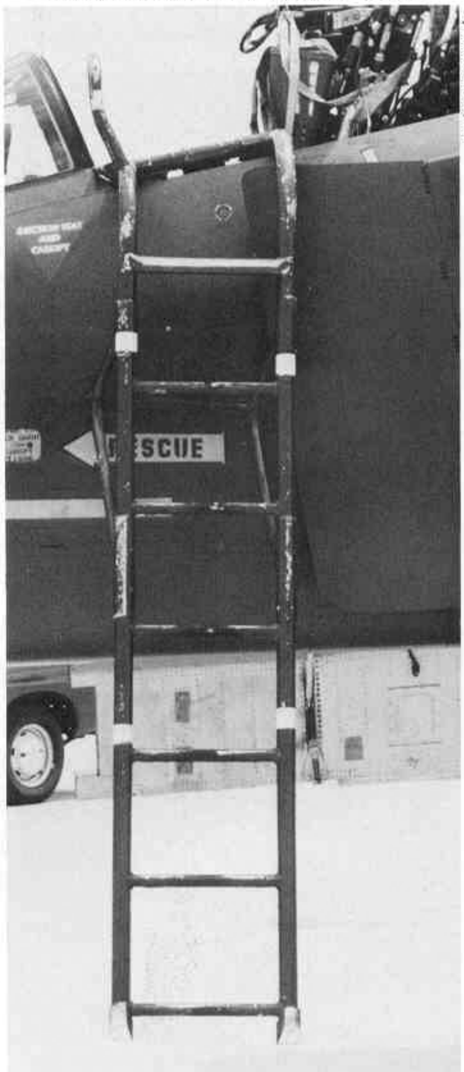
Jay Miller/Aerofax, Inc.

General Electric J79-GE-15 is normally transported on four-wheel dolly specially designed for F-4 powerplant maintenance requirements. Dolly is equipped with mechanical brakes and steering but has no independent power unit.



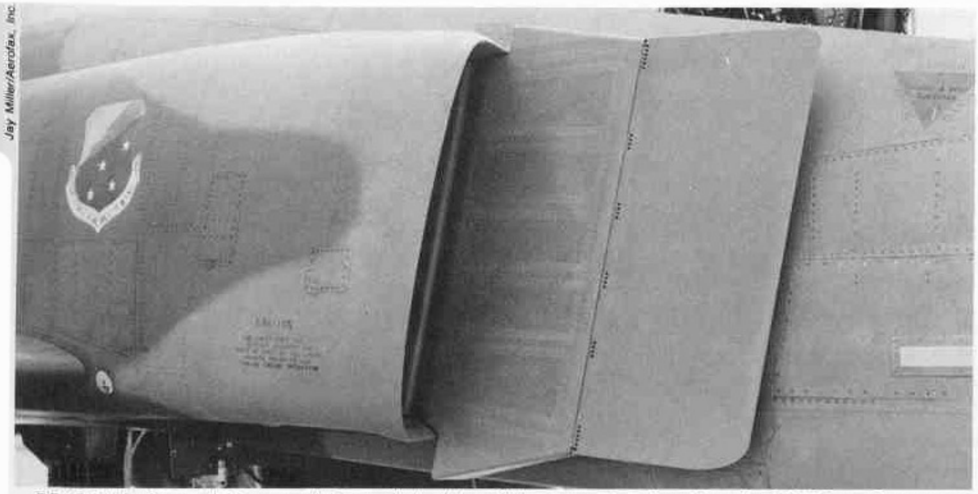
Jay Miller/Aerofax, Inc.

Oil tank for J79-GE-15 is mounted on top starboard side of compressor section. Intake bullet is supported by two power take-off arms that project at angles from the bottom two-thirds of the housing. Actual J79 makes up approximately first two-thirds of total engine length.



Jay Miller/Aerofax, Inc.

Ground ingress/egress ladder is standard for the F-4 family. Note extended hand grip.

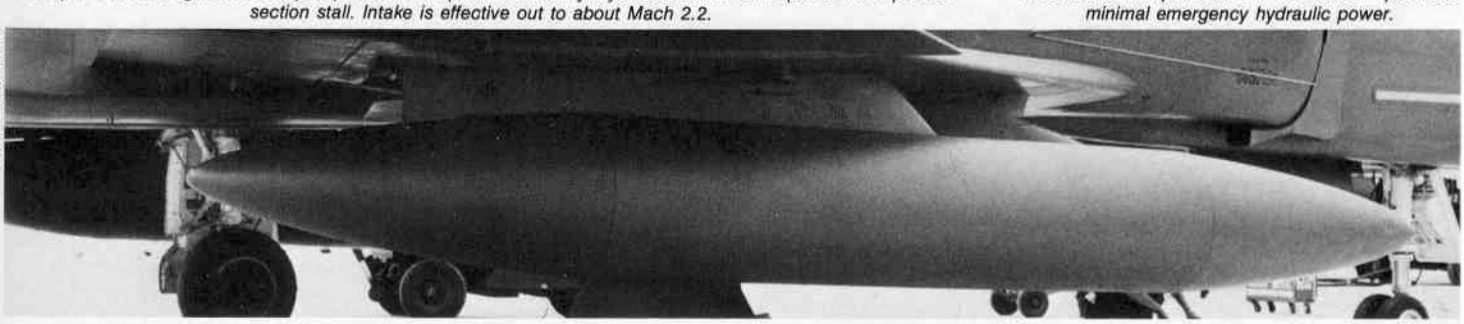


Jay Miller/Aerofax, Inc.

RF-4C intake is a variable ramp design optimized for efficient operation throughout the RF-4C's performance envelope. Second segment of ramp is perforated to permit boundary layer bleed in order to prevent compressor section stall. Intake is effective out to about Mach 2.2.

Jay Miller/Aerofax, Inc.

Ram air turbine is mechanically actuated and mounted on the port side of the aircraft. It provides minimal emergency hydraulic power.

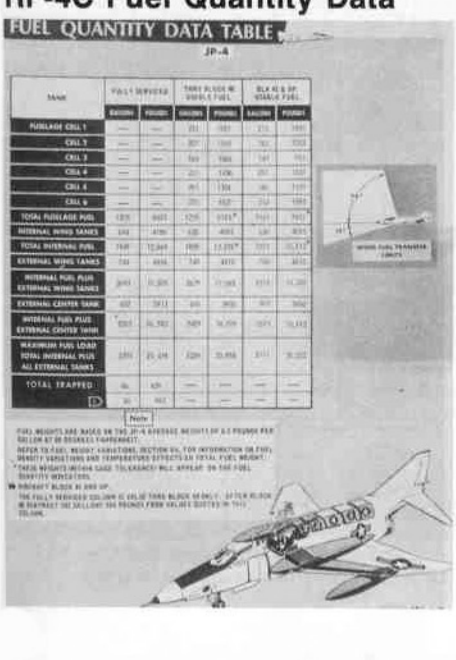


Jay Miller/Aerofax, Inc.

Jay Miller/Aerofax, Inc.

The RF-4C is capable of carrying two 370 gallon underwing drop tanks and one 600 gallon centerline drop tank. All three units are jettisonable. The wing drop tanks have been manufactured by both Sargent Fletcher and McDonnell. The centerline tank can be replaced by other stores or sensors and Pave Tack is now regularly seen in this position.

RF-4C Fuel Quantity Data



FUEL QUANTITY DATA TABLE

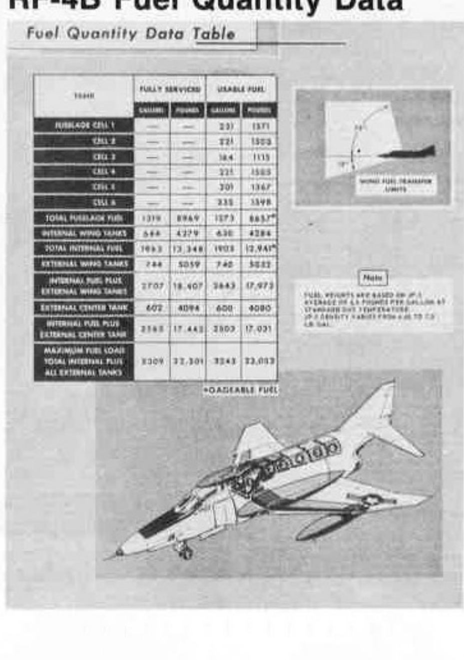
JP-4

TANK	FULLY SERVICED		[illegible] USABLE FUEL		[illegible] USABLE FUEL	
	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS
FUSELAGE CELL 1	—	—	[illegible]	[illegible]	[illegible]	[illegible]
CELL 2	—	—	[illegible]	[illegible]	[illegible]	[illegible]
CELL 3	—	—	[illegible]	[illegible]	[illegible]	[illegible]
CELL 4	—	—	[illegible]	[illegible]	[illegible]	[illegible]
CELL 5	—	—	[illegible]	[illegible]	[illegible]	[illegible]
CELL 6	—	—	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL FUSELAGE FUEL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
INTERNAL WING TANKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL INTERNAL FUEL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EXTERNAL WING TANKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
INTERNAL FUEL PLUS EXTERNAL WING TANKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EXTERNAL CENTER TANK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
INTERNAL FUEL PLUS EXTERNAL CENTER TANK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MAXIMUM FUEL LOAD TOTAL INTERNAL PLUS ALL EXTERNAL TANKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL TRAPPED	[illegible]	[illegible]	—	—	—	—
D	[illegible]	[illegible]	—	—	—	—

Note

[illegible]

RF-4B Fuel Quantity Data



Fuel Quantity Data Table

TANK	FULLY SERVICED		USABLE FUEL	
	GALLONS	POUNDS	GALLONS	POUNDS
FUSELAGE CELL 1	—	—	231	1571
CELL 2	—	—	221	1503
CELL 3	—	—	164	1115
CELL 4	—	—	221	1503
CELL 5	—	—	201	1367
CELL 6	—	—	235	1598
TOTAL FUSELAGE FUEL	1319	8969	1273	8657*
INTERNAL WING TANKS	644	4379	630	4284
TOTAL INTERNAL FUEL	1963	13,348	1903	12,941*
EXTERNAL WING TANKS	744	5059	740	5032
INTERNAL FUEL PLUS EXTERNAL WING TANKS	2707	18,407	2643	17,973
EXTERNAL CENTER TANK	602	4094	600	4080
INTERNAL FUEL PLUS EXTERNAL CENTER TANK	2565	17,442	2503	17,021
MAXIMUM FUEL LOAD TOTAL INTERNAL PLUS ALL EXTERNAL TANKS	3309	22,501	3243	22,053

*GAGEABLE FUEL

WING FUEL TRANSFER LIMITS

Note

[illegible]

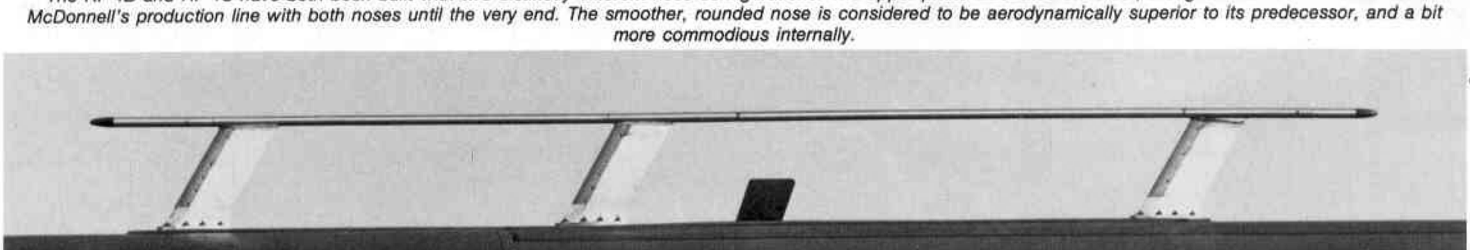
George Cockle

The RF-4B (shown) has a probe and a drogue inflight refueling system and the RF-4C a boom and receptacle system.

George Cockle

George Cockle

The RF-4B and RF-4C have both been built with two distinctly different nose configurations. The upper photo illustrates the older, though in fact RF-4's rolled from McDonnell's production line with both noses until the very end. The smoother, rounded nose is considered to be aerodynamically superior to its predecessor, and a bit more commodious internally.



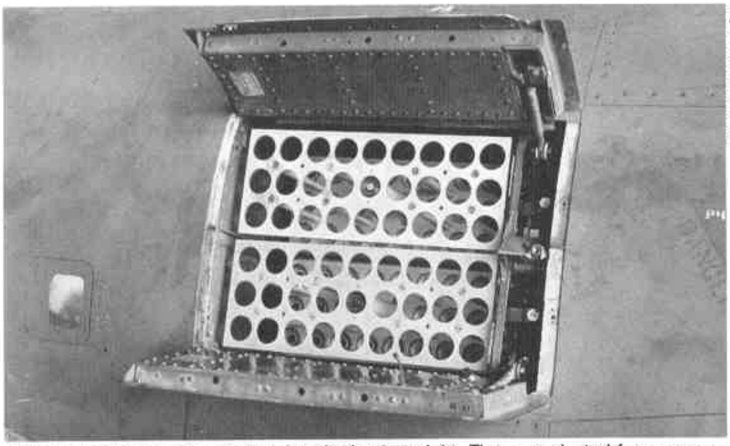
George Cockle

LORAN (long range radio aid to navigation) antennae equips a small number of RF-4C's. All of these aircraft have now been assigned to ANG units. The LORAN system uses the frequency bank from 1,700 khz to 2,000 khz. Reception over water ranges from 750 n. miles in the daytime to 1,400 n. miles at night.

George Cockle

George Cockle

There are no discernible differences between the noses of the RF-4B and the RF-4C. All sensor windows and RHAW antennas are externally similar. Close examination of the nose gear door, however, will reveal that the AF aircraft has two taxi lights mounted in the door and the Marine aircraft has only one. Note inflight refueling boom in extended position on the RF-4B.

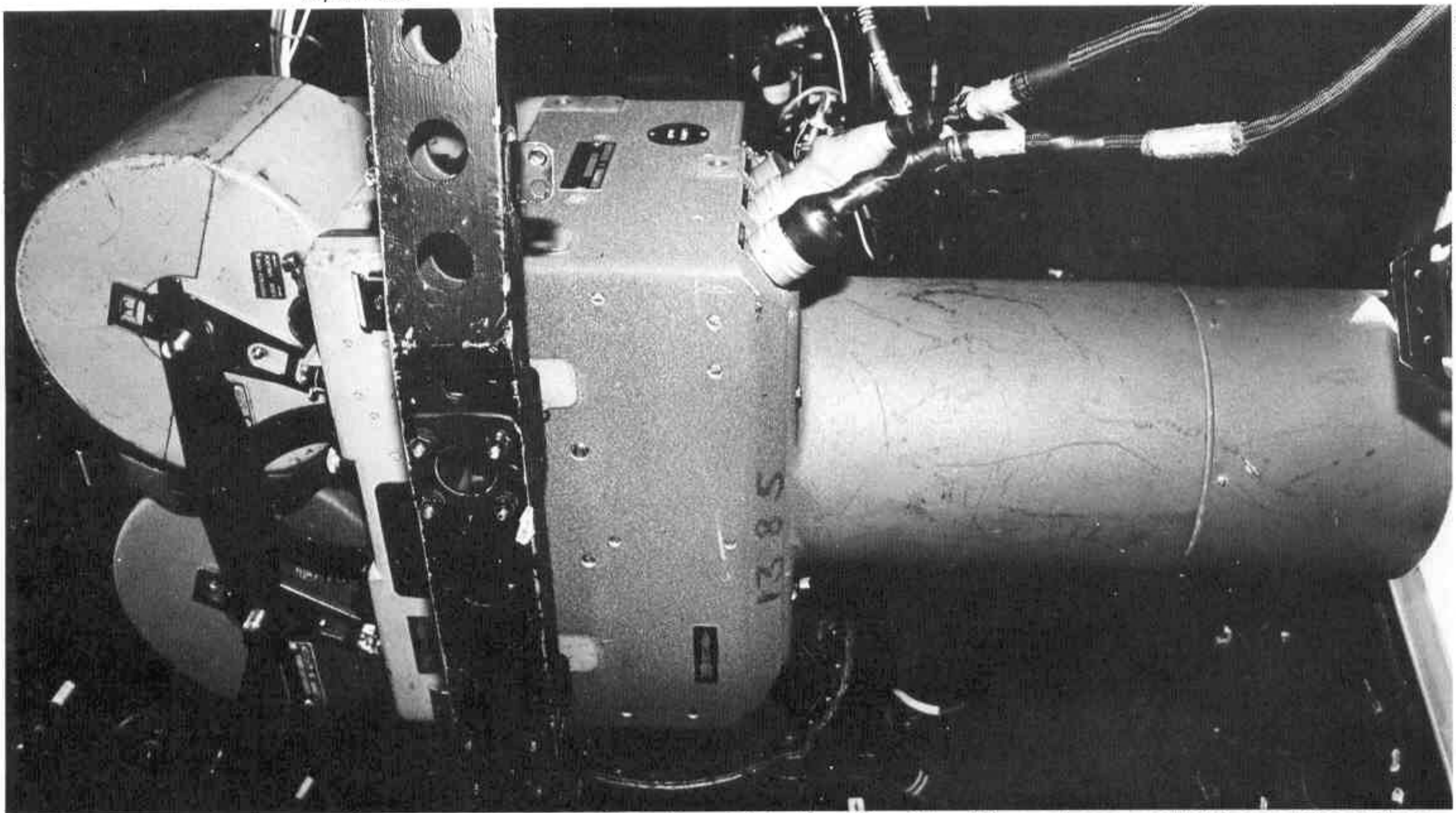


Jay Miller/Aerofax, Inc.

Flares permit optical imagery to be obtained at night. They are ejected from a compartment in the empennage section of the fuselage in coordination with photo requirements.

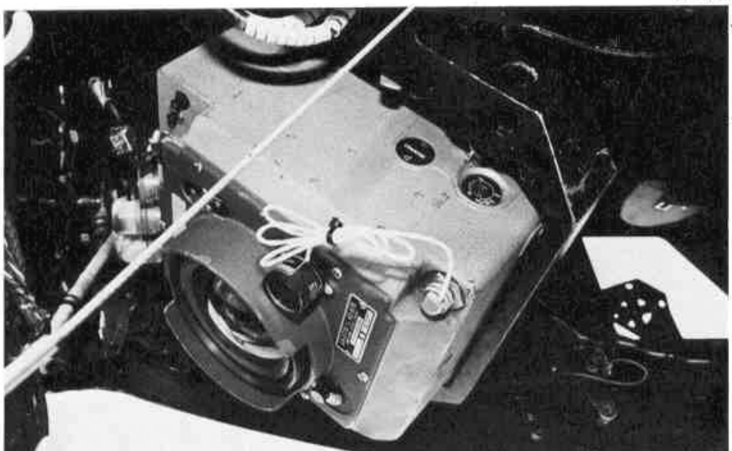
George Cockle

Camera compartment access requirements are accommodated by hinged lower panels. Three of the five optical sensor windows are readily visible in this photo.



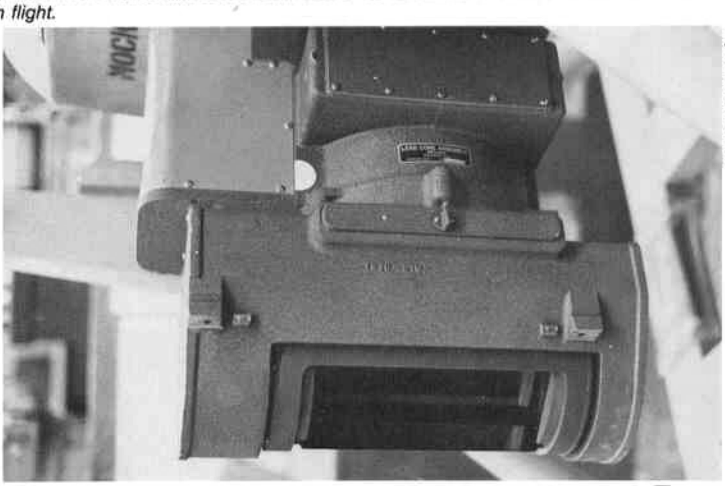
Jay Miller/Aerofax, Inc.

The largest standard configuration camera carried by RF-4's is the KS-87 with an 18" focal length lens. This unit is normally accommodated in nose station number 2, though a split vertical installation in station number 3 is possible. In station number 2, the KS-87 can be aimed to either side of the aircraft and can be rotated from side to side in flight.



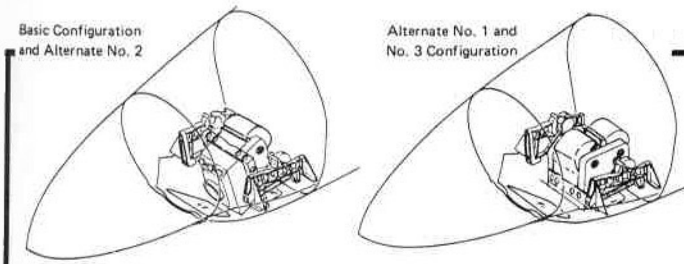
Jay Miller/Aerofax, Inc.

KS-87B installation in RF-4C camera station number 1. This is the basic camera arrangement for general purpose recce missions. It is also possible to mount the camera in a vertical position.



Jay Miller/Aerofax, Inc.

The mirror-equipped panning head of the KA-91 high-altitude panoramic camera. This unit has an 18" focal length and is capable of horizon to horizon coverage.

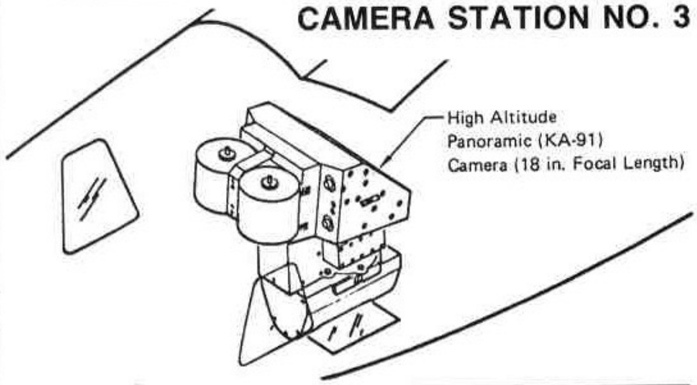


Camera Station No. 1 (Day/Night)					
Configuration		Basic	Alternate No. 1*	Alternate No. 2	Alternate No. 3*
Camera Installation	Type	KS-87	KS-87	KS-87	KS-87
	Number Required	1	1	1	1
	Focal Length	6 in.	6 in.	3 in.	3 in.
	Attitude	Forward Oblique	Vertical	Forward Oblique	Vertical
	Depression Angle	23.5°	90°	43.5°	90°

*Night Capability

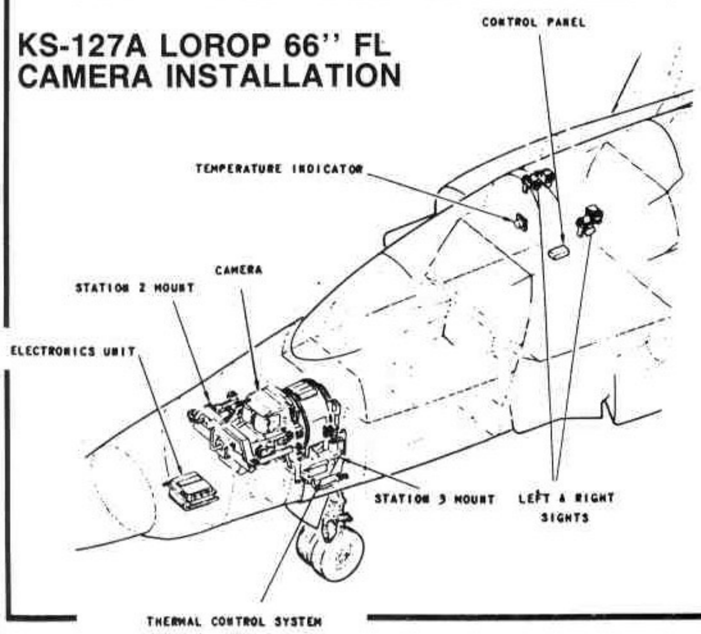
CAMERA STATION NO. 1

CAMERA STATION NO. 3

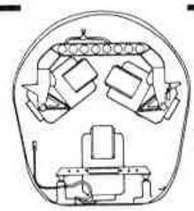


Configuration		Basic	Alternate No. 1	Alternate No. 2
Camera Installation	Type	KA-91	KS-87	KS-87
	Number Required	1	2	2
	Focal Length	18 in.	6 in.	18 in.
	Attitude	Vertical	Split Vertical	Split Vertical
	Depression Angle	90°	71.6°	83.7°

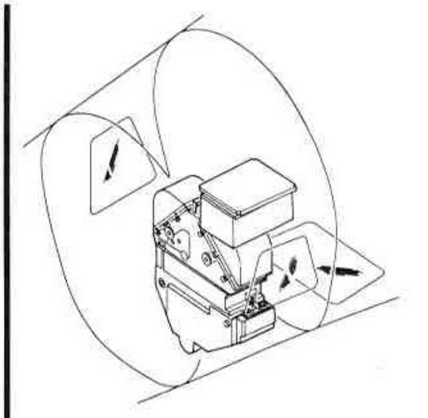
KS-127A LOROP 66'' FL CAMERA INSTALLATION

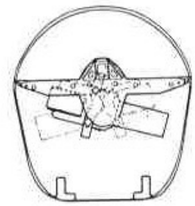


CAMERA STATION NO. 2



Alternate No. 1 Configuration
Tri-Camera Array, Still Picture Camera, KS-87





Basic Configuration KA-56
Low Altitude Panoramic Camera

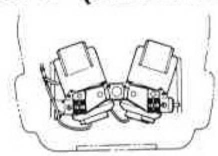
Alternate No. 2 and No. 3 Configurations
Left or Right Looking Still Picture Camera, KS-87
* (12 in. or 18 in. Lens Cone)

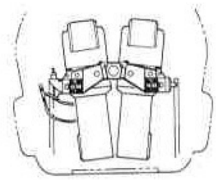
Camera Station No. 2 (Day/Night)					
Configuration		Basic	Alternate No. 1*	Alternate No. 2	Alternate No. 3
Camera Installation	Type	KA-56	KS-87	KS-87	KS-87
	Number Required	1	3	1	1
	Focal Length	3 in.	6 in. 6 in. 3 in.	18 in.	12 in.
	Attitude	Vertical	Vertical, Left and Right	Oblique Left or Right	Oblique Left or Right
	Depression Angle	90°	37.6° 37.6° 90°	5°, 15° or 30°	5°, 15° or 30°

*Vertical camera only of Tri-Camera Array has night capability.

CAMERA STATION NO. 3 (ALTERNATE)

Alternate Number 1 Configuration-
Split Vertical, KS-87 Still Picture Camera
(Framing Camera) 18 in. Lens Cone)

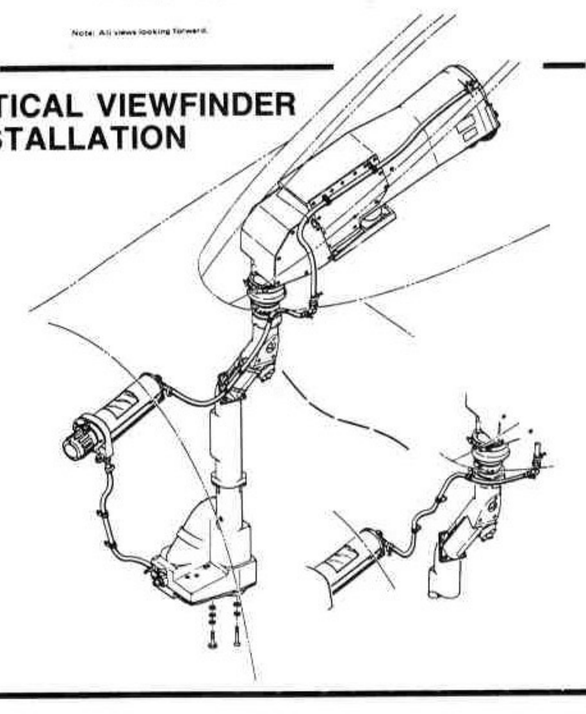


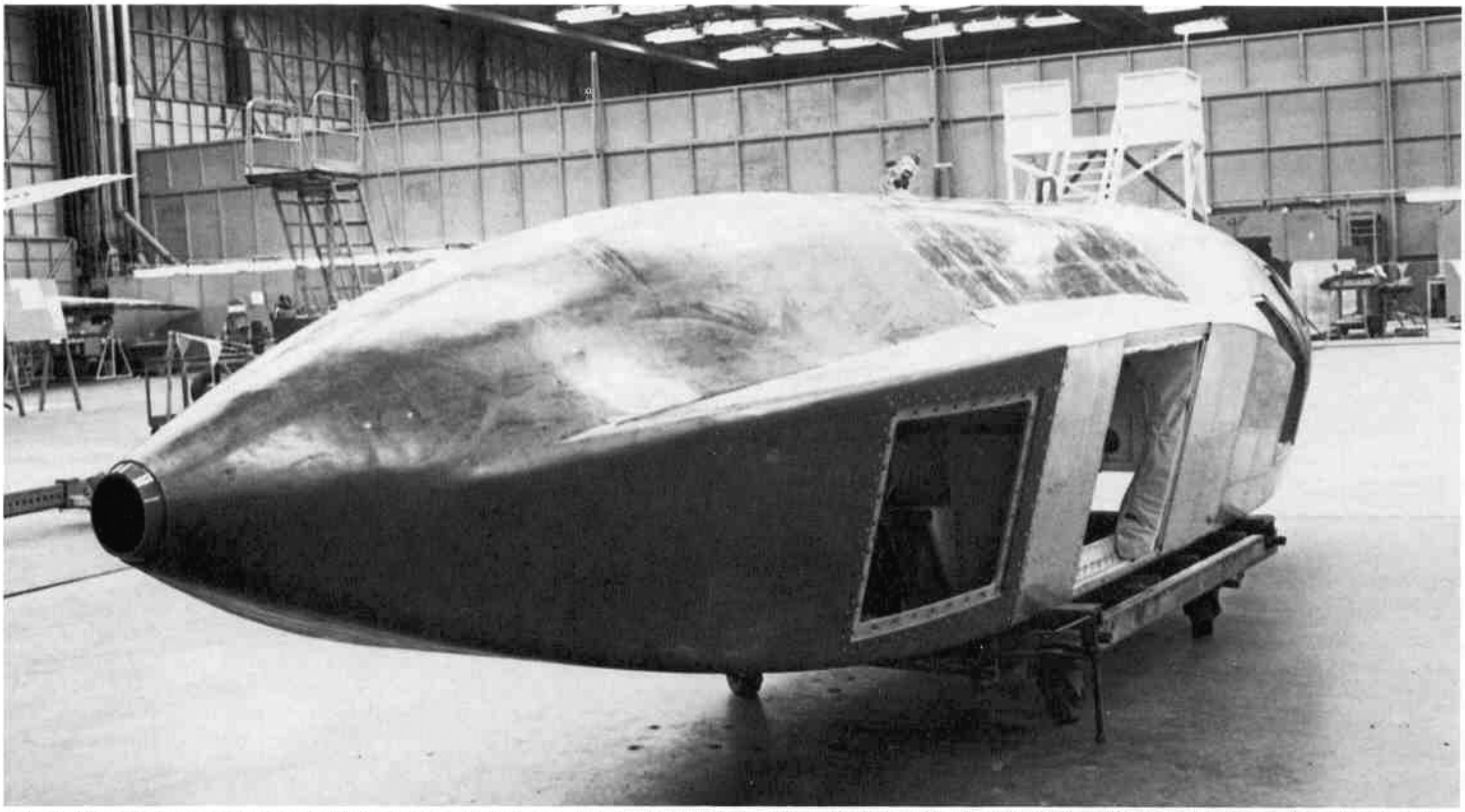


Alternate Number 2 Configuration-
Split Vertical Still Picture Camera,
KS-87 Still Picture Camera
(Framing Camera) (18 in. Lens Cone)

Note: All views looking forward.

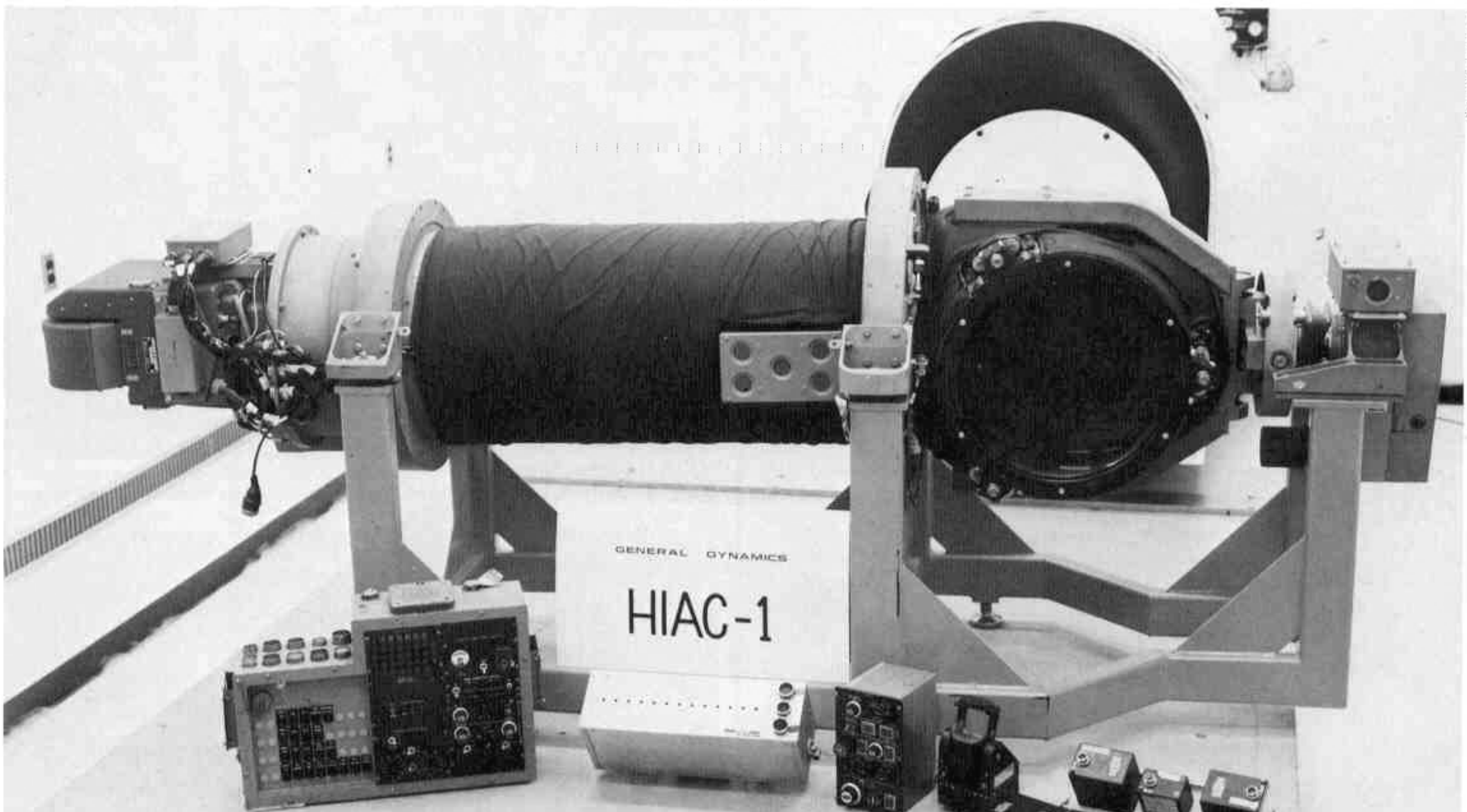
OPTICAL VIEWFINDER INSTALLATION





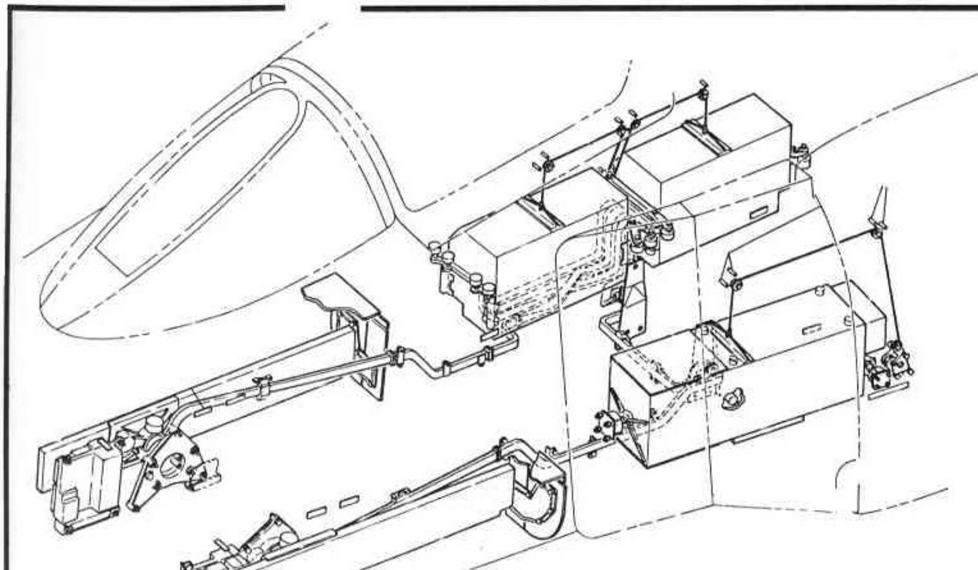
General Dynamics

The G-139 pod developed by General Dynamics was designed around the General Dynamics HIAC-1 66" focal length high-resolution LOROP camera. It could also easily accommodate other optical sensor systems, including the Itek KA-102. Under project "Peace Eagle", G-139-equipped RF-4's continue to monitor military activity all over the world.

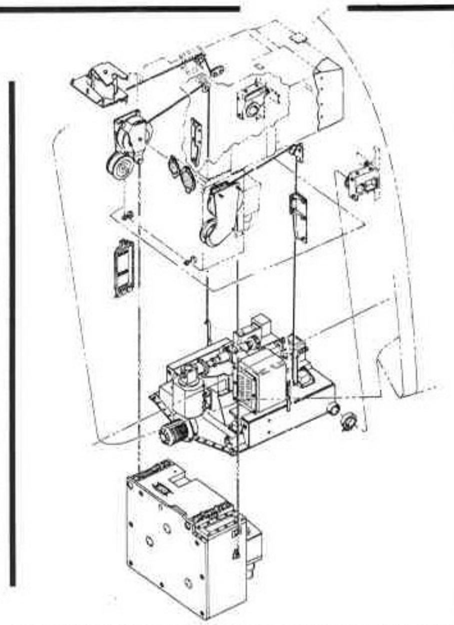


General Dynamics

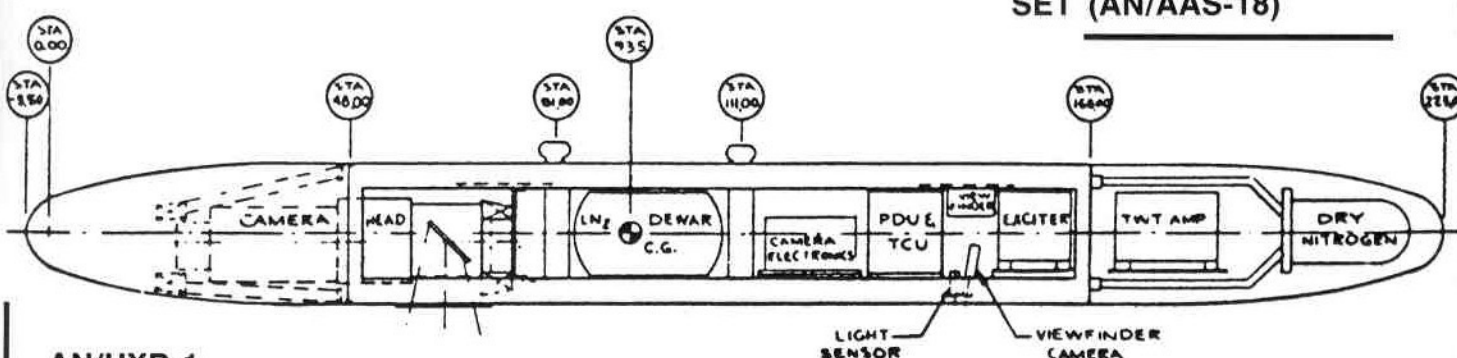
General Dynamics designed and built HIAC-1 high resolution 66" focal length LOROP camera incorporates a composite barrel and computer assisted aiming and focusing. The HIAC-1 weighs just over 1,000 pounds and provides 30" resolution specifications at ranges of over 60 miles. It can be transported either in podded form or internally. It has been installed in the General Dynamics RB-57F as well as the F-4E(S).



SIDE LOOKING RADAR EQUIPMENT INSTALLATION



INFRARED RECONNAISSANCE SET (AN/AAS-18)



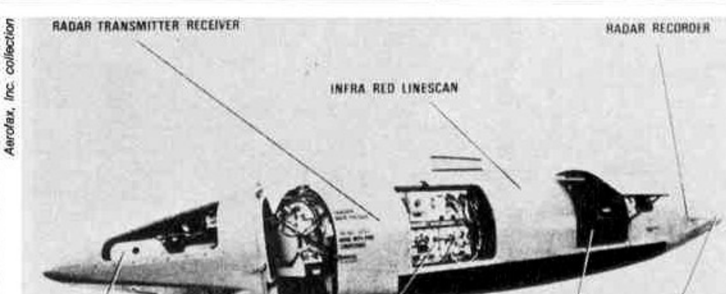
AN/UXD-1

The RCA AN/UXD-1 electronic camera system represents an early attempt at what is today considered the state-of-the art in sensor imagery technique. This unit, normally mounted on F-4 centerline attachments, was a real time image projection system that provided a surface resolution of 55 lines per mm, a ground resolution on film of 1' at 10,000', a normal display resolution of 3.5' (2' w/3:1 zoom), a cycle time of 14 seconds, and a mission available time of more than 2 hours. The lens had a focal length of 180 mm and an f-stop of 2.8. The focal plane shutter speed was 1/2000 to 1/125 sec. The data link range was 1 to 150 miles. The camera system weight was 135 pounds and its power requirement was 300 watts. Pod length was 18' and pod diameter was 22". Total weight was 1,100 pounds.

Joachim Streit

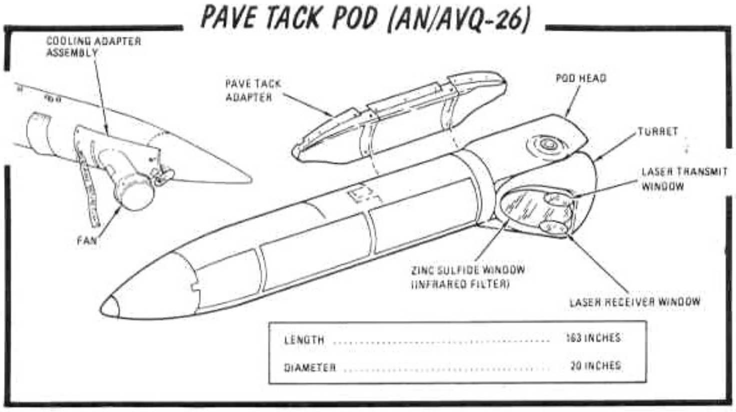
The WGAF has financed the design and development of an indigenous SLR pod for their RF-4E. A conventional 600 gallon centerline tank provides the aerodynamic shell for the WGAF SLR.

Aerofax, Inc. collection



EMI developed a reconnaissance pod for use by British F-4K and F-4M aircraft, the unit incorporated both passive and active sensors, including cameras and an SLR.

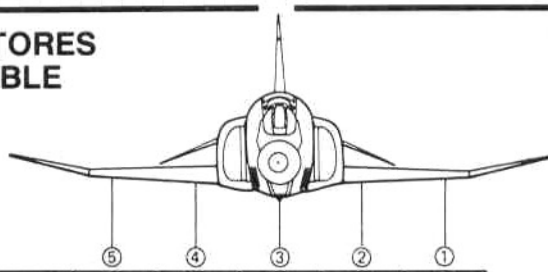
PAVE TACK POD (AN/AVQ-26)



Jay Miller/Aerofax, Inc.

Pave Tack is an exceptionally large laser designating unit with a variety of capabilities and uses. Active AF RF-4C units have recently integrated this pod into their operational inventory.

RF-4E STORES DROPPABLE



Store	BL 132.5	BL 81.5	℄	BL 81.5	BL 132.5
370 gal. Tank and Pylon	1				1
600 gal. Tank			1		
ALQ-71, -72 ECM Pod		1		1	
ALQ-119 ECM Pod		1		1	
Sidewinder (AIM-9B/E)		2		2	
LAU-3/A	3	3	3	3	3
BLU-1B/B	2	2	3	2	2
CBU-24 B/B and 49 B/B	3	3	5	3	3
M129E1	3	3	6	3	3
M-117 GP	3	3	5	3	3
MK-81 LDGP	6	3	6	3	6
MK-82 LDGP	6	3	6	3	6
MK-83 LDGP	2	3	3	3	2
SUU-23/A	1				1

George Cockle

Jay Miller/Aerofax, Inc.

RF-4 variants can accomodate a large number of ECM pods, including the AN/ALQ-101 (left) and the AN/ALQ-119 (right). The former is an older pod and is now rarely seen in service. The latter remains active in the operational inventory, though system updates are periodically integrated in order to keep the unit viable. Pods are normally carried on the inboard wing pylons.

Tim McGovern collection

Using Minnesota ANG RF-4C, 64-1023, test work was undertaken in late 1983 to explore the attributes of configuring RF-4's with AIM-9 "Sidewinder" air-to-air missiles for purposes of self-defense. Several live firings were conducted, though the results of the program remain unannounced.

AEROFAX, INC. would like to take a moment to introduce you to our new MINIGRAPH series. These high-quality, authoritative booklets have been created for the serious enthusiast and modeler and are designed to provide textual and pictorial detail not usually found in other readily available mini-monograph books of this type.

An extensive title listing is currently in preparation. It is planned that a release rate of at least six titles per year will be maintained. MINIGRAPHS presently available (marked with an *) or due for delivery during 1984 include the following:

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***MINIGRAPH 2: MCDONNELL DOUGLAS F-15A/B**
***MINIGRAPH 3: GRUMMAN F-14A/B**
MINIGRAPH 4: MCDONNELL F-4D
***MINIGRAPH 5: MCDONNELL F-101B**
MINIGRAPH 6: BOEING B-52G/H
MINIGRAPH 7: GRUMMAN EA-6A/B
MINIGRAPH 8: BOEING P-26A
MINIGRAPH 9: NORTH AMERICAN RA-5C
MINIGRAPH 10: ROCKWELL SPACE SHUTTLE
MINIGRAPH 11: LOCKHEED P-3A/B/C/D/E
MINIGRAPH 12: SAAB J-35 DRAKEN VARIANTS
MINIGRAPH 13: MCDONNELL RF-4 VARIANTS

If you find the new MINIGRAPH series to your liking and would like to have your name added to our mailing list, please drop us a line at P.O. Box 120127, Arlington, Texas 76012. We would like to hear from you and would particularly appreciate comments, criticisms, and suggestions for future titles.

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AEROFAX, INC. also would like to mention that a new aviation magazine, to be called AEROFAX QUARTERLY, is in the works and due for release in the spring of 1984. If you would like to have your name added to the mailing list of those who will be receiving introductory copies and introductory subscription rates, please write.

And don't forget the other fine AEROFAX, INC. publications, including the AEROGRAPH series covering the General Dynamics F-16, the Air Guard, and the Lockheed U-2. Forthcoming, AEROGRAPH titles include the Douglas A-3 and the Convair B-58.

AEROFAX, INC. looks forward to hearing from you....

Sincerely,
Jay Miller and
the AEROFAX
Editorial Staff

RECONNAISSANCE MAPPING PATTERNS

RF-4C PHANTOM II (AIR FORCE - AIR NATIONAL GUARD) ①
SENSOR CONFIGURATION

Reference: IT-4(R)C-2-27

Station	Camera	Focal Length (inches)	Depression Angle (degrees)	Camera Position	Camera Type
1	KS-87 ②	3	35.9, 45.5	Oblique (Forward)	Frame
	KS-87	3, 6	90	Vertical	Frame
	KS-87	6	23.5	Oblique (Forward)	Frame
2	KA-56	3	90	Vertical	Panoramic
	KS-87	3	90	Vertical	Frame
	(2) KS-87	3	30	Oblique (L & R)	Frame
	(2) KS-87	6	37.5	Oblique (L & R)	Frame
	KS-87	12, 18	5, 15, 30	Oblique (L or R)	Frame
	KA-1	24, 36	90	Vertical	Frame
3	KC-1/T-11	6	90	Vertical	Frame
	KA-55	12	90	Vertical	Panoramic
	KA-90 ②	24	90	Vertical	Panoramic
	KA-91 ②	18	90	Vertical	Panoramic
	(2) KS-87	6, 18	71.6, 83.7	Vertical (Split)	Frame
	KS-87	18	90	Vertical	Frame
4	AN/APQ-102 Side Looking Airborne Radar or AN/APD-10 Radar Mapping Set ③				
5	AN/AAS-18 Infrared Mapping System or AN/AAS-5 Infrared Reconnaissance Set				

RF-4B (MARINE CORPS)
SENSOR CONFIGURATION

Reference: NAVAIR-01-245FDC-1

Station	Camera	Focal Length (inches)	Depression Angle (degrees)	Camera Position	Camera Type
1	KS-87 ②	6	23.5	Oblique (Forward)	Frame
	KS-87	6	90	Vertical	Frame
2	KA-56	3	90	Vertical	Panoramic
	(2) KS-87	6	37.5	Oblique (L & R)	Frame
	(2) KS-87	6	30	Oblique (L & R)	Frame
	KS-87	18	5, 15, 30, 90	Oblique (L or R) Rotatable Mount	Frame
	KS-87	12, 18	1, 15, 30	Oblique (L or R)	Frame
3	KA-55	12	90	Vertical	Panoramic
	KS-87	18	90	Vertical	Frame
	(2) KS-87	6, 18	71.6, 83.7	Vertical (Split)	Frame
	KA-82	12	90	Vertical	Panoramic
4	AN/APQ-102 Side Looking Airborne Radar or AN/APD-10 Radar Mapping Set ③				
5	AN/AAS-18 Infrared Mapping System or AN/AAS-5 Infrared Reconnaissance Set